THE

Living Temple

J. H. Kellogg

By J. H. KELLOGG

"Know ye not that your body is the temple of the Holy Ghost?" 1 Cor. 6: 19

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Preface

In this little volume, the author has sought to present in a simple, but comprehensive way, those facts which are of greatest interest and importance in relation to the structure, the functions, and the proper care and training of the body. The scientific facts adduced are in accord with the latest and most authentic researches. The interpretations of facts and the conclusions reached, the author trusts the reader will find worthy of careful study and earnest consideration, and in harmony with the fundamental teachings of both nature and Holy Writ.

The Apostle Paul in his declaration, "Your body is the temple of the Holy Ghost," simply gave expression to a fact which the most profound scientific researches in the fullest degree corroborate. So far as the author is aware, this work represents the first attempt which has been made to make a systematic study of the body and its care from the standpoint of Paul's declaration, which is unquestionably the expression of a great truth, the significance of which has been for ages overlooked.

To meet in advance a question which may arise in the minds of some, it may perhaps be proper to state here that, while many references to Scripture have been made in this work, it has been no part of the author's purpose to write a theological treatise, but simply to study man from a physiological standpoint; hence, in the use of the word "temple,"

as it appears upon the title-page and in numerous places in the work, the physiological, or literal, sense is to be understood. That man, considered as a spiritual temple, can be such in the fullest sense only when he is ruled by a will which is in complete accord with that of his Creator, is self-evident. Of the several senses, then, in which the word is used in the Scriptures and in common speech, one only is employed in this work, as explained above.

Certain popular modern theories have inculcated the idea that man, starting from a lowly origin on a level with or scarcely above that of the brute creation, has gradually attained to his present development, supposed to be the highest the race has ever reached. After having gained almost universal acceptance, these theories of human development have in recent times come to be regarded with growing skepticism by many authorities eminent in science and philosophy, because of their utter failure to account for the origin of man or the animal creation and because of the overwhelming accumulation of facts which indicate that on the whole the human race is declining in vigor and stamina rather than advancing. The blight of physical, mental, and moral decadence is weighing heavily upon the human race in every land, in every stage of development. Whole tribes of men are becoming extinct, while new species of maladies and new varieties of known diseases are constantly making their appearance. Insanity, epilepsy, and imbecility have increased three hundred per cent in fifty years. At the present rate of increase, these defectives will in fifty years more constitute one per cent of the entire population. The race is rapidly going down.

This multiplication of disorders and degenerates is the

natural result of perverted habits and the cultivation of abnormal appetites. Civilized man has departed far from the natural, the divine way of life. The increase of disease, of mental and moral infirmities, is but the natural result of the gross transgressions of the laws of man's being which have come to be almost universal. Departing from the way of life marked out for him by his Creator, man has sought out many inventions, the soul- and body-destroying influences of which are clearly evident to the thoughtful observer.

It is the earnest hope of the author that this little work may serve as a beacon light to some who are seeking a better way of life; that it may make clear to those who peruse its pages that there is no conflict between true science and true religion, but that sound science cannot be irreligious nor true religion unphilosophical; that to be truly spiritual is to be in the highest sense natural; that man is not totally depraved and turned over to the control of malignant agencies, but is a child of Heaven, a son of God, the image and representative of his Creator, placed in the world to stand as a ruler and a prince, to subjugate every force and every object to noble and divine purposes, and to work out an eternal and felicitous destiny through co-operation with the divine Spirit within him, which created him, which maintains him, which heals his diseases, which shares his griefs and sorrows and all his earthly experiences, and which is ever drawing him upward toward heavenly and supernal ideals, supplying both the incentive and the power requisite for attaining to the best in this life and in the life to come.

If many of the views presented in this work differ from those which the reader has previously entertained, the author

begs that they may not be rejected without fair consideration; for although the sentences of this work have been somewhat hurriedly penned in hours stolen from much-needed rest, the views presented have not been hastily formed, but are the outcome of many years of careful thinking and wide study of the fruits of others' thinking, and it is believed will bear the test of careful and considerate scrutiny. If this volume shall be the means of awakening a few truth-seeking men and women to a clearer knowledge of their divine origin and their noble mission and destiny, and shall serve to combat in even some small degree the tide of ignorance and error which is rapidly sweeping the race downward toward irretrievable ruin and extinction, the author will feel amply rewarded for his efforts.

In conclusion, the author desires to acknowledge his indebtedness for many valuable suggestions and emendations to A. T. Jones and Dr. E. J. Waggoner, as well as other friendly critics, who have carefully read the work, either in the manuscript or in proof sheets. J. H. K.

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Contents

Illustrations.

The Mystery of Life

FOR ages men have sought to solve the mystery of life. Philosophers have speculated, chemists and naturalists have delved deep into the secrets of matter, living and inert; but they have brought back only a report of fathomless depths of mystery, of unknown and incomprehensible energies, too subtle for the most delicate balance, too vast for apprehension or expression, intangible, yet mighty in overcoming the forces of the inanimate world, and able to build up immense structures, such as the giants of the forests and the monarchs of the animal world, and equally active in the tearing asunder of mountain peaks, which crumble beneath the dissolving action of lichens and mosses, and are split and pulverized by the wedge-like action of the roots of pines and other mountain trees.

The Brotherhood of Being.

This wonderful life is active all about us in an infinite variety of forms; in bird, insect, fish, reptile, and all the million creatures which people the earth and sea, we recognize one common Life,—a kindred force which springs in every limb that leaps and moves, which throbs in every beating heart, thrills through every nerve, and quivers in every brain. We behold also a like evident brotherhood or sisterhood of life in vegetable forms, joining in one common family the stately cedars of Lebanon's rugged sides with the grasses of the plain, and the molds and mosses of the ancient wall.

While human knowledge stands mute respecting the origin of life, investigation has gone far enough to show that life is one,—that animal life and vegetable life are not merely kindred lives, but are really one and the same.

The manifestations of life are as varied as the different individual animals and plants, and parts of animated things. Every leaf, every blade of grass, every flower, every bird, even every insect, as well as every beast or every tree, bears witness to the infinite versatility and inexhaustible resources of the one all-pervading, all-creating, all-sustaining Life.

As we go about plucking flowers and leaves, trampling upon the grass, perhaps crushing under our feet a score of ants, beetles, worms, or other humble creatures, we seldom stop to think of the vast extent of the abounding life above and all about us. Think, for a moment, of the grass, that commonest of all plants. It is more interesting than it appears to be, for the botanists have sorted out five thousand different species or more. What a magnificent carpet the green grass spreads over all the fertile earth in every clime where an unencumbered soil is found, and every blade witnesses to active life, shaping and forming it down in the darkness of the soil, and pushing it up to the air and the sunlight. And then the leaves, so many that were they stripped from all the trees, and spread out upon the earth, a surface of more than forty-two million square miles would be covered; and yet no two leaves and no two blades of grass have ever been found exactly alike.[1] Calculate the number of blades of grass in an acre, and in a square mile, and remember that every one is a witness to the active presence of the one infinite, abounding Life.

1 The author once counted the blades of different varieties of grass growing on one square foot of a grassy bank, and found more than four hundred.

In springtime, and in autumn especially, we are taught most impressive lessons of the marvelous activity and energy of life. In the early spring, when the snow has just left the ground, and the trees stand bare and leafless, the earth covered only with faded autumn leaves, and brown, frost-bitten grass blades, the world seems dead, as though life had departed for some other clime or world; but after a few days of sunshine, what a marvelous transformation! The sun's warm rays have thawed the frozen soil, and touched the roots of herbs, of shrubs, and of trees. The ascending sap has reached the farthest tip of every branch and twig; buds swell and burst; a bright, fresh mat of green appears upon the earth; soon, flowers bloom, green garments clothe the swaying boughs,— a veritable resurrection scene, for nature was not dead, but sleeping, awaiting her allotted time.

Estimate the amount of energy required to lift the sap in all the trees and bushes of a thickly wooded forest. Many gallons of water are evaporated daily from the surface of a tree of average size. An eminent botanist is responsible for the statement that a single corn plant which is approaching maturity, sweats half as much as a man, which would represent evaporation at the rate of one or two ounces of water per hour. Estimate the amount of water lifted up from the earth by a square mile of such green plants, or a thousand square miles.[1] Every spring is a revelation of creative power, a repetition of the creative work which first carpeted the earth with green, and clothed it with all the glories of the rainbow shining forth in multicolored blooms, and stocked the Edenic farm with marvelous birds and beasts, who, joining man,

1 With rows four feet apart and one stalk to the foot the amount would be not less than 62.5 barrels to the acre.

2

sent forth to greet each rising sun, one grand, melodious, swelling note of praise. The thought is beautifully expressed by Lowell: —

> "Every clod feels a stir of might,
> An instinct within it that reaches and towers,
> And, groping blindly above it for light,
> Climbs to a soul in grass and flowers."

God's Multiplication Table.

When autumn comes, each tree, each shrub, each tiny plantlet, brings its store of garnered energy in ripened seed, in fruit, or nut,— a little bundle of life deftly wrapped and sealed, carefully prepared to serve its purpose in the economy of the world. Think of the energy represented in all the acorns, all the wheat, all the corn, and all the nuts and seeds which ripen in the sunlight of the late summer and early autumn days! Each grain of corn planted in the springtime has been multiplied to several hundred grains. The farmer may carry his seed corn to the field in a bag upon his shoulder, but horses and wagons are needed to carry back the harvest in the fall. Think of it! each pound of corn increased to two, three, or four hundred, or even a thousand pounds.[1]

Whence comes this enormous, never-ceasing, inexhaustible stream of energy flowing into the world through the medium of the vegetable kingdom? This is a question which philosophy has sought in vain to fathom. But the mystery is not so great as human philosophy has taught us. The real

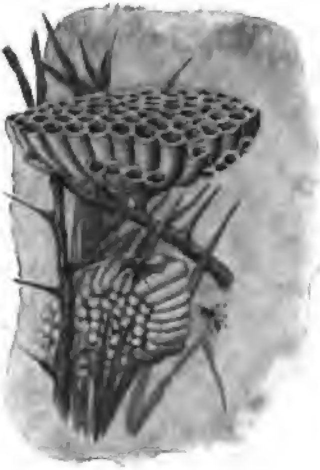
[1] Each pound of corn represents more than seven thousand units of energy, sufficient to lift five million pounds one foot high, or half a ton nearly a mile high. Multiplied by four hundred, this energy becomes sufficient to lift two hundred wagon loads perpendicularly to a height of one mile. This is one item in God's multiplication table.

THE NEST OF A COLONY OF WEAVER BIRDS.

NEST OF THE AMERICAN GOLDFINCH.

FORTRESS CONSTRUCTED BY THE TOWER-BUILDING CICADA.

AMERICAN BEAVER CONSTRUCTING A DAM.



Paper Cells Constructed by the Polistes.

A Wasp's Nest.

'EST AND SUBTERRANEAN RETREAT OF THE TARANTULA.

The Underground Labyrinth of the Trap-Door Spider.

mystery is not in the fact, but is the outgrowth of false reasoning, incorrect hypotheses, false premises,— the attempt to make facts conform to human theories, instead of accepting the plain, simple teachings of nature and the Word of God.

Life Not a Blind Force.

Let us note that the operations of life are not blind, aimless, confused, uncertain, or indefinite, but uniform, logical, intelligent, sensible. When one looks into the processes of nature, he is at once impressed with the infinite common sense displayed; he recognizes an intelligence, a sense of fitness, of proportion, of adaptation, which is like his own. He sees that the intelligence manifested in the activities of living things is akin to human intelligence. Let us notice a few illustrations.

Divinely Instructed Builders.

Consider, for example, the marvelous ingenuity shown by animals and birds of various species in the construction of their homes. What wonderful wisdom is displayed by the oriole, and other birds, in the selection of suitable locations for their nests! What astonishing dexterity is exhibited in weaving together the various materials employed in their construction! Note the wonderful mechanical skill of the bee in the formation of the cells in which it stores its sweet treasures. Observe the mechanical skill of the mole, the muskrat, the beaver, and the various other builders of the woods and fields.

Wonderful Animal Intelligence.

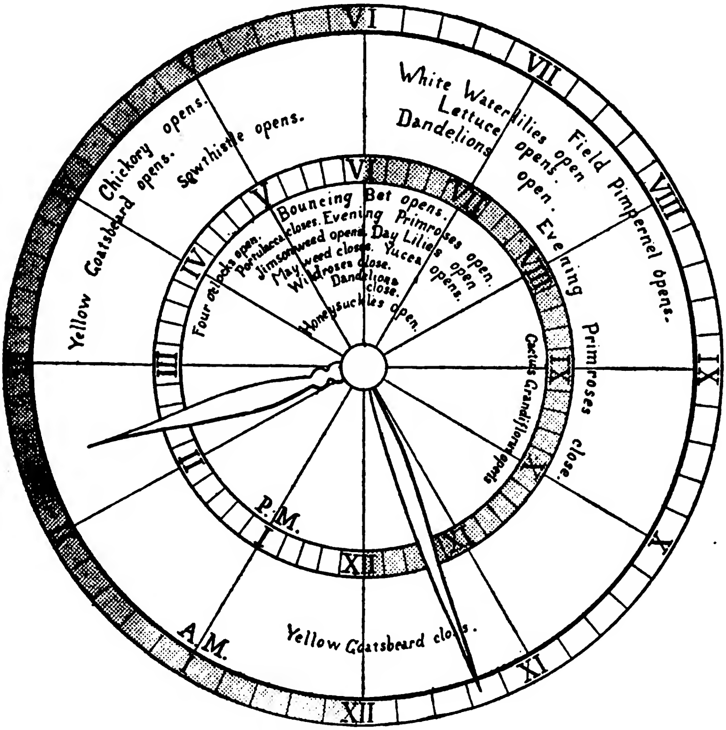
How universal is the divinely implanted instinct of mother love. The most timid bird becomes marvelously courageous and fearless in defense of the little hatchlings in her nest.

In obtaining food, in overcoming obstacles, in extricating themselves from emergencies, in escaping from pursuers, what human-like intelligence is manifested by all the million tribes of the animal kingdom! An eminent naturalist tells a story of a fox, which, when pursued by hounds, threw its enemies off the scent by springing upon the back of a sheep, and clinging fast, while the frightened animal ran a sufficient distance to break the trail which the hounds were following. "Doubling" is a common device employed by hunted animals. Wolves tire out their prey by driving the pursued animal in a circle and taking turns in the chase. Partridges decoy dogs away from their nests by fluttering near the ground as though wounded, to attract their attention, and after having enticed them to a safe distance, suddenly rise into the air with a note of triumph and defiance. Animals not infrequently associate themselves together, as do men, for defense against a common enemy. Deer and buffalo have been known to surround a pack of pursuing wolves, and rushing in upon them, crush them to death. In regions frequented by hunters, animals soon learn the methods of trappers and hunters, and become so dexterous in evading them that human endurance and wits are frequently taxed to the utmost to cope with them.

Marvelous Intelligence Manifested in Plants.

In the growth and habits of plants, also, there is abundant evidence of the presence of this universal Intelligence. This is wonderfully seen in the sudden awakening of the vegetative life of earth in the springtime, answering the call of the vernal sun, whose rays, creeping down through the clouds, whisper to the buried seeds and rootlets that the time has come to awaken from the long winter sleep, and enter upon the activities of the summer's work. This marvelous springtime resurrection

is to us such a common circumstance that we cease to wonder at it. It seems a matter of course that the warmth and light of the sun should stimulate plant life and growth,—but how and why? What is the difference between the dead tree and the live tree, between the live seed and the dead or blasted



A BOTANICAL CLOCK.

seed? We say, Life has departed from the dead seed, but this mere statement is not an explanation. The dead seed and the live seed look exactly alike. In the springtime, the dead tree and the live tree may resemble one another so closely

in outward appearance that only an expert can tell the difference. One hears the call to activity, and responds; the other is deaf, because dead, lifeless.

Each plant comes forth at just the proper time. The trailing arbutus blooms even before the snow has left the ground. Wild roses come in June; other flowers come in August, and others still later in the year. Some flowers open and close at regular hours of the day, so that it is possible even to construct a botanical clock.

The attempt to explain, on purely physical grounds, the curious fact that leaves always turn toward the light, the sunflower even following the sun with closest fidelity from sunrise until sunset, has utterly failed. An unerring Intelligence guides the plant to hold its leaves in such position as to receive, to the fullest extent, the vitalizing light which energizes its cells, and carries forward the marvelous metamorphosis by which the gases of the air and the soluble substances brought up from the earth are transformed into wood, bark, leaves, flowers, and fruit.

The Strange Instincts of Carnivorous Plants.

A strange, one might almost say a perverted, intelligence is manifested in the order of vegetable forms known as insectivorous, or insect-eating plants. All plants need nitrogen, a substance which is found in albumin, and which abounds in animal forms of all sorts, but is often almost entirely lacking in available forms in the air and soil. Insectivorous plants grow in sandy or rocky places, or in bogs where almost no nitrogen is obtainable. It appears, then, that they capture insects only because they are starved, and not because of any particular liking for this most extraordinary diet. When in captivity, and supplied with earth containing a sufficient amount of

nitrogen, insectivorous plants quickly sicken when freely fed with meat or insects.

The intelligence shown in plants in the mechanical contrivances provided for their fertilization, for the production and scattering of their seeds, and for protection from destructive animals or insects is truly wonderful. In the case of many plants, definite provision is made for the co-operative assistance of insects in conveying pollen from one flower to another, and in performing other necessary offices for the plant; for example, red clover depends upon the humblebee for fertilization,— that is, for seed production,— so that without the humblebee this species of clover would soon run out. Similar facts are known of many other plants.

Intelligence in the Inanimate World.

Even in the inanimate world, the evidence of an intelligent power is ever present before us. "That which may be known of God is manifest in them [to them]; for God hath shewed it unto them. For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead, so that they are without excuse." Rom. 1:19, 20.

Every drop of water, every grain of sand, every snow crystal, every floating cloud, every thunder peal, every lightning flash, the hurricane, the cyclone, the tidal wave, the earthquake, the rain, the dew, the rainbow, the rising sun, the changing moon, the stars which shine and circle in infinite space, the motes which dance and glitter in every sunbeam,— every object and operation in nature speaks of an active, controlling Intelligence possessed of infinite power and capacity.

"Who layeth the beams of his chambers in the waters: who maketh the clouds his chariots: who walketh upon the

wings of the wind. . . . He sendeth the springs into the valleys, which run among the hills. . . . He watereth the hills from his chambers: the earth is satisfied with the fruit of thy works. . . . The trees of the Lord are full of sap; the cedars of Lebanon, which he hath planted. . . . He causeth the grass to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth." Ps. 104:3, 10, 13, 16, 14. "He giveth snow like wool: he scattereth the hoarfrost like ashes. . . . He sendeth out his word, and melteth them: he causeth his wind to blow, and the waters flow." Ps. 147:16, 18. "For he draweth up the drops of water, which distil in rain from his vapor; which the skies pour down and drop upon man abundantly." Job 36:1, 27, 28, R. V.

Gravitation—The Evidence of a Universal Unifying Intelligence.

When Newton observed the apple falling from a tree, and set about working out the principles which govern the law of gravitation, he did not discover a new force or a new principle; for men had known from the earliest time that apples and other things fall when released from a point of support above the earth. But Newton discovered that this law extends beyond the earth; that it rules the moon in its revolutions about the earth, and the planets in their circling around the sun. And modern astronomers have discovered the same law in operation in star systems almost infinitely far away in space; so we now know that if a new sun were created so far away that light, traveling at the rate of one hundred and eighty thousand miles per second, would reach us only at the end of ten thousand years or more, this earth and every other sun and planet in the universe would instantly feel the

pull of the newborn orb. Here is unity, infinite, all-comprehending, an evidence of the universal presence which comprehends every atom of matter and every cubic inch of space in all the wide universe.

It is only recently that men of science have come to recognize the fact that, in the presence of this great universal force of gravitation, we stand before the Infinite. But that divinely taught master of philosophy, Paul of Tarsus, expressed this wonderful thought almost nineteen centuries ago, when he wrote to the Colossians, "For in him were all things created, that are in heaven, and that are in earth, visible and invisible, . . . and he is before all things, and *in him all things consist*" (margin, R. V., "in him all things hold together"). Col. 1:16, 17.

The Infinity of Power.

The human mind cannot grasp the immensity of power by which the worlds, the suns, the vast orbs which spangle the heavens, and send their light to us at distances almost too great for mathematical expression are held in place. The earth weighs fifteen hundred billion billion tons, yet, compared with the sun, it is a mere speck. The moon is distant 238,000 miles from the earth, and yet the sun is so vast that if the earth were at its center, there would be abundance of room for the moon to revolve about it in its orbit, with almost two hundred thousand miles of space to spare. One of our nearest starry neighbors in the sky is a hundred times as great as the sun, and other stars may be immensely larger. The earth is traveling through space at the rate of nineteen miles a second. To start a five-pound cannon ball off through the air at this rate would require nearly two tons of gunpowder, or about eight hundred times its own weight; hence

the force required to start the earth off on its journey through space, at the rate it is now traveling if developed by the explosion of gunpowder, would require not less than six hundred billion billion (600,000,000,000,000,000,000) tons.

Try to imagine the power required to set in motion such giant planets as Jupiter and Saturn,— such inconceivably greater bodies, as our sun, and the still greater suns which are scattered through the broad expanse of infinite space.

The Hidden Forces in a Snowball.

We little appreciate the forces in operation right about us,— for example, a half-pound snowball, which a boy tosses into the air, represents, according to Professor Tyndall, between its snowy dust and the watery vapor into which it may be converted, a force sufficient to propel it through the air a distance of two hundred and seventy miles,— the distance between Detroit and Chicago. The force employed in holding together the atoms of hydrogen and oxygen, of which it is composed, would propel it from a cannon's mouth with a force sufficient to send it halfway across the continent, or from New York to Denver, and would equal the force which would be exerted upon the earth by a thousand pounds falling a distance of half a mile. Think of this vast power wrapped up in one small snowball, and try to compute the amount of energy represented in a compact layer of snow, one foot deep, covering one square mile, and then think of the force hidden in such a blanket of snow covering a continent!

The Energy Manifested in Snow and Rain.

Water weighs sixty pounds to the cubic foot. Compute the weight of the water precipitated upon the earth by a one-inch rainfall covering one hundred square miles (nearly 7,000,000 tons), and estimate the amount of force required to ele-

vate this water to the height of one mile,— 18,055,984 horse power. It has been estimated that the actual power required to evaporate the water of a single heavy rain over a hundred square miles is equal to the work of eight thousand million horses, or sufficient to run all the machinery of the world. Try to compute the energy of wind moving at the rate of twenty-seven miles an hour, and exerting a pressure of 3.64 pounds a square foot. Estimate the amount of power which would be exerted by such a wind upon the side of a mountain range a mile high and a thousand miles long, which would be nearly 50,000,000 tons. Think of the terrific force exerted by a volcanic eruption, by an earthquake upheaval, by a tidal wave ten feet high rolling against the side of a continent.

While trying to grasp, in a meager way, the immensity of these great forces, let us remember that "power belongeth unto God." Ps. 62:11.

The psalmist recognized this fact, when he sang, of old, "The voice of the Lord is upon the waters: the God of glory thundereth: the Lord is upon many waters. The voice of the Lord is powerful; the voice of the Lord is full of majesty. The voice of the Lord breaketh the cedars; yea, the Lord breaketh the cedars of Lebanon. He maketh them also to skip like a calf; Lebanon and Sirion like a young unicorn. The voice of the Lord divideth the flames of fire. The voice of the Lord shaketh the wilderness; the Lord shaketh the wilderness of Kadesh." Ps. 29:3–8. What a picturesque description of the earthquake, the volcanic eruption, and the thunderstorm! Let us, like David, recognize the voice and the power of God in these mighty works of nature.

The astronomer, Herschel, when he first turned his great telescope upon the milky way, discovered that what was supposed to be a cloud of vapor, was in fact a great bank of

glowing suns so thickly set together and so far away that their light commingles. The astronomer fainted, overwhelmed with the magnitude of the conceptions which crowded in upon his mind.

Surely, nature speaks to us in tones most majestic and overwhelmingly convincing, and her declaration is always positive and clear that God "worketh all in all" (margin, "all and in all"). 1 Cor. 12:6. "The heavens declare the glory of God; and the firmament showeth his handiwork." Ps. 19:1. "Lift up your eyes on high and see who hath created these things, that bringeth out their host by number." Isa. 40:25.

God the Explanation of Nature.

There is a clear, complete, satisfactory explanation of the most subtle, the most marvelous phenomena of nature,—namely, an infinite Intelligence working out its purposes. God is the explanation of nature,—not a God outside of nature, but in nature, manifesting himself through and in all the objects, movements, and varied phenomena of the universe.

Says one, "God may be present by his Spirit, or by his power, but certainly God himself cannot be present everywhere at once." We answer: How can power be separated from the source of power? Where God's Spirit is at work, where God's power is manifested, God himself is actually and truly present. Said an objector, "God made the tree; it is true, just as a shoemaker makes a boot; but the shoemaker is not in the boot; so God made the tree, but he is not in the tree." The objector overlooked the fact that the process of tree-making in the living tree, is never complete so long as the tree is alive. The tree does not create itself; a creative power is constantly going forward in it. Buds

and leaves come forth from within the tree; does the tree create them? Acorns are put forth from within the oak tree; each acorn is a little tree, which, when planted, may grow into an oak as large as the parent tree. Does the tree create the acorn? Can a tree make trees? If so, then every plant, every shrub, every insect is a creator,— and man is a creator. "It is he that hath made us, and not we ourselves." Ps. 100: 3. Suppose now we have a boot before us,— not an ordinary boot, but a living boot, and as we look at it, we see little boots crowding out at the seams, pushing out at the toes, dropping off at the heels, and leaping out at the top,— scores, hundreds, thousands of boots, a swarm of boots continually issuing from our living boot,— would we not be compelled to say, "There is a shoemaker in the boot"? So there is present in the tree a power which creates and maintains it, a tree-maker in the tree, a flower-maker in the flower,— a divine architect who understands every law of proportion, an infinite artist who possesses a limitless power of expression in color and form; there is, in all the world about us, an infinite, divine, though invisible Presence, to which the unenlightened may be blind, but which is ever declaring itself by its ceaseless, beneficent activity. "The heavens declare the glory of God; and the firmament showeth his handiwork." Ps. 19: 1, 7; 33: 7; Job 38: 8; Isa. 40: 12, 26.

Infinite Intelligence a Personal Being.

"But," says one, "this thought destroys the personality of God. Do you not believe in a personal, definite God?" Most certainly. An infinite, divine, personal being is essential religion. Worship requires some one to love, to obey, to trust. Belief in a personal God is the very core of the Christian religion. The conception of God as the All-Energy, the infinite Power, an all-pervading Presence, is too vast for

the human mind to grasp; there must be something more tangible, more restricted, upon which to center the mind in worship. It is for this reason that Christ came to us in the image of God's personality, the second Adam, to show us by his life of love and self-sacrifice the character and the personality of God. We can approach God only through Christ.

"Who being the brightness of his glory, and the express image of his person, and upholding all things by the word of his power, when he had by himself purged our sins, sat down on the right hand of the Majesty on high."

"Who being the effulgence of his glory, and the impress of his substance, and upholding all things by the word of his power."

The apostle says, "But we all, with open face beholding as in a glass the glory of the Lord, are changed into the same image from glory to glory, even as by the Spirit of the Lord." 2 Cor. 3:18. How apt and beautiful is this figure! By holding up a looking-glass a few inches square, we may see in it an infinitely varied picture,—mountains, valleys, streams, lakes, forests, rocks, sky, and clouds, covering miles and miles of space, and we may see the reflection of a star millions of miles away. With a slight change of position, the glass gives us a new picture,—every change brings a new view. So, in beholding Christ in his miracles, his temptations, his exhortations, his life of self-abnegation, his "going about doing good," we may behold the personality and power of God. And what a great hope there is for us in the fact that in Christ we find qualities not strange and foreign to humanity, but kindred mental and moral characteristics; so that we are able to see and grasp an actual, rather than merely a theological or abstract or figurative truth, in the declaration of the apostle, "Now are we the sons of God." 1 John 3:2.

The fact that God is so great that we cannot form a clear mental picture of his physical appearance need not lessen in our minds the reality of His personality, neither does this conception disagree with that of a special expression of God in some particular form or place. Indeed, there are scriptures which present God in this definite, and one may say circumscribed, form as sitting upon a throne in heaven, or as dwelling in the temple at Jerusalem. 1 Kings 22:19; Ps. 11:4; Matt. 21:12, 13.

The human mind is finite and cannot grasp infinity. We naturally desire to form a definite, clearly defined conception of the being whom we worship. The Bible supplies this human need as well as all other of our spiritual requirements, and in the fortieth chapter of Isaiah the prophet deals with this question of God's personal appearance in a marvelous way. "O Jerusalem, that bringest good tiding, lift up thy voice with strength; lift it up, be not afraid; say unto the cities of Judah, Behold your God! He shall feed his flock like a shepherd: he shall gather the lambs in his arms, and carry them in his bosom."

"Who hath measured the waters in the hollow of his hand, and meted out heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales, and the hills in a balance? To whom then will ye liken God? Or what likeness will ye compare unto him? Have ye not known? have ye not heard? hath it not been told you from the beginning? have ye not understood from the foundations of the earth? It is he that sitteth upon the circle of the earth, and the inhabitants thereof are as grasshoppers; that stretcheth out the heavens as a curtain, and spreadeth them out as a tent to dwell in: To whom then will ye liken

me, or shall I be equal? saith the Holy One. Lift up your eyes on high, and behold who hath created these things, that bringeth out their host by number: he calleth them all by names by the greatness of his might, for that he is strong in power; not one faileth. Hast thou not known? hast thou not heard, that the everlasting God, the Lord, the Creator of the ends of the earth, fainteth not, neither is weary? There is no searching of his understanding. He giveth power to the faint; and to them that have no might he increaseth strength. Even the youths shall faint and be weary, and the young men shall utterly fall: but they that wait upon the Lord shall renew their strength; they shall mount up with wings as eagles; they shall run, and not be weary; and they shall walk, and not faint." Isa. 40:9, 11, 12, 18, 21, 22, 25, 26, 28–31.

Here is a most marvelous description of God. His hand, his arm, his bosom are mentioned. He is described as "sitting on the circle of the earth," he metes out heaven with the span, he holds the waters in the hollow of his hand; so there can be no question that God is a definite, real, personal being. A mere abstract principle, a law, a force could not have a hand, an arm. God is a person, though too great for us to comprehend, as Job says, "God is great and we know him not." Job 36:26. A hand large enough to hold the waters of the earth in its hollow would be as large as the earth itself. Hence no human eye could ever see more than a very small fraction of it at a time. A span great enough to mete out even the earthly heavens would cover at least 9,000 square miles. Try to form a conception of a hand of such proportions; when outstretched, the distance from the tip of the thumb to the tip of the little finger would be 9,000 miles. The height of a person is nine times the length of the span, so the height

of a being with such proportions must be at least 81,000 miles. It is just as easy to conceive of a person filling all space as of a person having a height equaling ten times the diameter of the earth.

This great being is represented as sitting on the circle of the earth. The orbit of the earth is nearly two hundred million miles in diameter. A being so great as to occupy a seat of such proportions is quite beyond our comprehension as regards his form. The prophet recognizes this, and so diverts our attention away from speculation respecting the exact size and form of God by showing us the absurdity of trying to form even a mental image, intimating that this is closely akin to idolatry. See verses 18–21. He then shows us where to find a true conception of God, pointing us to the things which he has made: "Lift up your eyes on high and behold who hath created these things." This also was Paul's idea: "For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse." Rom. 1:20.

Discussions respecting the form of God are utterly unprofitable, and serve only to belittle our conceptions of him who is above all things, and hence not to be compared in form or size or glory or majesty with anything which man has ever seen or which it is within his power to conceive. In the presence of questions like these, we have only to acknowledge our foolishness and incapacity, and bow our heads with awe and reverence in the presence of a Personality, an Intelligent Being to the existence of which all nature bears definite and positive testimony, but which is as far beyond our comprehension as are the bounds of space and time.

Sons of God.

From the earliest ages the thought has existed in the human mind, that man is not a mere product of the earth, as modern philosophers would have us believe, but a son of God. The earliest traditions of the Greeks and Romans, as well as of other nations, have recognized the fact that man is the "offspring" (Acts 17:28) of a divine parent, that he is the son of God, and bound by kinship to his Progenitor,—made "in the image of God." Gen. 1:27. The image has become debased by sin, disease, and degeneracy, yet, even in its worst estate, still represents something of those divine attributes which lift the human race so immeasurable above the highest representatives of the animal kingdom.

This doctrine was clearly taught by Paul in his famous sermon delivered from Mars' Hill, at Athens, of which we have a record in Acts 17:22–29. "God that made the world and all things therein, seeing that he is Lord of heaven and earth, dwelleth not in temples made with hands. . . . For in him we live, and move, and have our being; as certain also of your own poets have said, *For we are also his offspring.*" Acts 17:24, 28.

King William I of Germany once visited a German school, and while addressing the children, held up a stone, and asked the question, "To what kingdom does this belong?"—"To the mineral kingdom, sir," a bright boy at once responded. Holding up a flower, the king asked, "And to what kingdom does this belong?"—"To the vegetable kingdom, sir," replied another pupil. Then, pointing to himself, the king inquired, "And to what kingdom do I belong?" There was silence. The loyal lads held their noble king in too great respect to classify him along with horses, cows, dogs, and other animals, and for a moment there was no response. Then a

thoughtful boy arose, and with a grave and reverential air, replied, "To God's kingdom, sir." The boy was right; the text-books are wrong. Man cannot be classed with the lions, tigers, apes, kangaroos, jackals, and other "beasts of the field." He is not simply an extraordinarily smart ape—"a cooking animal," as one has said. He is a creation by himself, a son of God, and born a king. It is a glorious thing for him to know this. The writer will never forget an incident which impressed this thought indelibly upon his mind: While in a mission meeting, listening to the testimonies borne by convicts, drunkards, gamblers, and other depraved men who had been rescued by the power of the gospel of Christ from their evil lives, a poor, shabbily dressed colored boy arose, and with a ringing voice and a beaming countenance, began his testimony thus: "Some people are proud of their lineage,—I am proud of mine; I am the son of a King; I am a brother to Jesus Christ." The sincerity and the joyful exultation which rang forth in the clear voice of the rescued lad thrilled through the audience like an electric shock, and probably every listener felt more clearly than before, the reality of the kinship that exists between man and his Maker.

"Not Far from Every One of Us."

One of the saddest mistakes man has made, is in putting God so far away from himself. Said Paul, God is "not far from every one of us." Acts 17:27. Christ said, "I am the life" (John 14:6), and David said, He "is the strength of my life." Ps. 27:1. Let us accept this as a literal, physiological fact, as a scientific truth which is attested by myriads of witnesses in the natural world about us, as well as by the word of God. Scientific men have ceased the attempt to prove man to be a mere product of physical forces, but they

recognize in his existence, and in every function of his body, the presence of an infinite Intelligence, working, controlling, creating, for man's good. God dwells in man. He is the life of man. He is the servant of man.

What Is Man?

Job asked the question, "What is man?" The atheist answers, "A body." A certain class of religious thinkers have answered the question, "A body possessed of a soul." A large number of theologians would answer, "A soul possessing a body." Certain modern teachers declare man to be merely an idea. The Bible answers, Man is dust, animated by a divine life; when this life is withdrawn, and the spirit returns to God who gave it, the body returns to dust from which it was made, and man is naught.

In succeeding chapters we shall study the body from this standpoint, and shall be able to find in the bodily functions the most wonderful and interesting evidence of the presence of a controlling intelligence beneficently serving man with infinite wisdom, patience, and forbearance.

A General View of the Temple

"A HOUSE NOT MADE WITH HANDS."

THE oldest authority on the nature and origin of human life is the book of Genesis, in which we are told that "the Lord God formed man of the dust of the ground." Gen. 2:7. Solomon, the wisest of men, in describing death, says, "Then shall the dust return to the earth as it was." Observation confirms this truth. The body of a man or an animal subjected to the action of heat or of chemical substances may be quickly reduced to dust. In nature, the change is effected by the aid of minute animal and vegetable organisms which, acting successively upon the body, gradually reduce it to the original elements from which it was builded.

The Composition of Human Dust.

An examination of human dust shows that it is not a miscellaneous collection of earthy elements, but composed of a few special forms of dust or matter. The following table shows the different kinds of substances, and the amounts of each sort which enter into the formation of the body of a person weighing one hundred and forty-eight pounds (Marshall): —

	Pounds.
Oxygen	116.56
Carbon	19.98
Hydrogen	13.46
Nitrogen	3.70
Calcium	1.93
Phosphorus	1.70
Potassium	.03
Sulphur	.22

	Pounds.
Chlorine	.13
Sodium	.15
Magnesium	.001
Iron	.014
Fluorine	.118
Silicon	.0003

It must not be supposed that the elements above named constitute the whole body; they represent, rather, what is left after the living body has been destroyed,— the ashes of the body,— and may also be regarded as the dust out of which the body was originally formed, either directly or indirectly. While combined in the body, they as little resemble the elements which the chemist handles as do the pigments which compose the coloring of a beautiful portrait or a landscape resemble the formless mixtures spread out upon the easel of the artist. The artist's deft fingers mingle and temper the raw material with which he works, and with patience and skill combine them on the canvas until a luminous face, a brilliant sunset, or a sparkling waterfall beams forth. So the divine Artist weaves from the humblest, crudest materials that exquisitely delicate and unsurpassingly beautiful fabric which we call the body, but which God himself has designated as a temple, and which he has honored by making his own dwelling place. "Know ye not that ye are the temple of God, and that the Spirit of God dwelleth in you [literally, lives with you]." 1 Cor. 3:16.

Can Atoms Think?

The wisest man on earth cannot produce the smallest speck of living matter out of human dust. It is only God, the Master Builder, the infinitely skilled Modeler who can produce living, sentient, thinking substance out of the common elements of the earth and air. Joseph Cook, the celebrated Boston preacher,

once asked the question, "Can matter feel? Can atoms think?" Certainly we must reply in the negative, but we should also have to give a negative answer to any other question ascribing power or activity to matter, to atoms. Dust cannot feel, nor think, nor grow, nor act in any other way; it can only be acted upon. Dust modeled into the form of a man, is still only dust. The pigments woven into a portrait are still nothing more than dead, inert colors. The plan of the picture, its charm, and its beauty are wholly due to the subtle skill of the artist woven in with the colors. It is the thought of the artist, the picture in his soul, which he has made to shine out from the canvas, that impresses us as we look upon it. We never once think of the pigments, or the brushes with which they were laid on. These are not the picture. It is the combination, the plan, the idea, which constitutes the essence of the picture. The paint and canvas are simply the vehicles of expression. But the picture is only a dumb, lifeless thing, after all,— it is merely the shadow or ghost of the living thing. The divine Artist goes a step farther than the highest point which any human artist can ever attain. God modeled the form divine, tinted and polished and embellished it with beauty unsurpassed, and then animated it by putting himself into it to be its life, its strength, its wisdom, its intelligence, its preserver,— even its servant. "I am the way, the truth, and the life: no man cometh unto the Father, but by me." John 14:6.

"The Lord is the strength of my life; of whom shall I be afraid?" Ps. 27:1.

"The Lord giveth wisdom: out of his mouth cometh knowledge and understanding." Prov. 2:6.

"Thy judgments are a great deep: O Lord, thou preserveth man and beast." Ps. 36:6.

"Thou hast made me to serve with thy sins; thou hast wearied me with thine iniquities." Isa. 43:24.

The Divine Masterpiece.

A great artist once, by an infinite amount of painstaking labor, painted his own portrait. This feat was looked upon as something marvelous. Certainly it was great for human achievement; but the portrait, after all, was nothing more than a piece of cloth with a thin layer of paint upon it. But the divine Artist not only made man in his own likeness, so that he might reflect in his form and outward appearance the divine symmetry and beauty of the thought of the Master Artist, but after having made him, or in the act of forming him, God actually entered into the product of his creative skill, so that it might not only outwardly reflect the divine conception, but that it might think divinely, and act divinely, and thus fittingly constitute the masterpiece of creative skill.

A corpse is not a man; it is dust. The glory and the light have faded away with the life. The temple is desolate; the Shekinah has departed. Dust alone cannot constitute a man. Man is a product of that wonderful creative skill which constructs from dust a form and dwells therein.

It is important that we should recognize the fact that God creates every man. We often fall into error by a careless or superficial use of terms,— we say that "nature does this or that," forgetting that nature is not a creator. What we call "nature" is simply the picture of divine activity which we see spread out about us in the universe. God is not behind nature nor above nature; he is in nature,— nature is the visible expression of his power. "Christ is all, and in all." Col. 3:11.

Creation a Continuous Process.

Job understood this, for he says, "The Spirit of God hath made me." Job 33:4. So also did David, for he said, He "hath made us, and not we ourselves." Ps. 100:3. The human builder first builds his house, and when it is finished, moves into it. If serious repairs are needed, he moves out until they have been completed. The divine Builder occupies the house as he builds it, and remains a permanent occupant as long as the house stands. But the building of the living house is never finished. Its very life depends upon a perpetual tearing down and rebuilding, a constant renewal by replacement, so that there is not a moment from birth to death that the presence of the divine Builder is not absolutely essential. God not only forms a man from the dust of the ground, but continues to form him as long as he lives; and the moment the creative process ceases, the walls of the temple totter and fall, its timbers fall apart, and the whole edifice crumbles back to dust. This thought, ever present with us, will lead us to care tenderly for the temple's needs, to seek to harmonize our wills with that of the divine occupant, to co-operate with God in such a way that we may be true witnesses of his skill and wisdom, his beneficence and power. "Ye are my witnesses, saith the Lord." Isa. 43:10.

The Structure of the Temple.

The living temple is alive in all its parts; each minute cell or particle, each microscopic thread, has a life of its own. A bit of tissue placed beneath a microscope shows it to be made up of separate, distinct, perfectly formed, and exceedingly minute parts, varying greatly in shape, color, and use, but all comprised under the general name of "cells." This is true of all living forms. And, what is very remarkable and

interesting, there is a wonderful similarity, and sometimes almost a complete identity, between the cells which comprise the bodies of animals and those of vegetables. This will be very clearly seen by reference to the accompanying illustrations, which show some of the different varieties of cells.

Some vegetables, as the yeast plant, consist of one single cell, and the minute vegetables known as germs and microbes are of this class. There are also animals which consist of a single cell. The amœba, a minute animal found in ditch water and stagnant pools, affords an excellent sample of a single-celled animal.

The Smallest Animals.

It will be interesting and instructive to study carefully one of these one-celled animals. If there is a ditch or pond near by, it would be easy, in the summer time, to obtain specimens for study by the aid of a good microscope. If the ponds and ditches are frozen up, or if none are accessible, a small pond may be easily arranged by putting a little hay in a saucer with hydrant water, and setting it away for two or three weeks in a warm place. Care must be taken to supply water daily to take the place of that which evaporates, so as to keep the hay always moist. The assistance of a good microscope is required, also one who is expert in the examination of these minute specks of life, as they are very small, and so different in appearance from larger animals, that one would not suspect them to be animals at all, if the fact had not been determined by careful study of their habits. They appear to be simply minute drops of colorless, transparent jelly, containing a few granules which give them a grayish appearance. They are so small that eight hundred and fifty of them, arranged side by side, are required to make a row an

inch long. When resting, or dead, the amœba is quite round, — a circular disc. When active, however, its shape is continually changing. It has no mouth, and yet when in need of food, it eats, making a mouth for the purpose. It flows itself over or around the food particle, and engulfs it, just as a drop of water flowing down a pane of glass may pick up particles of dust. Its food consists of minute vegetables, as germs, or even animated specks of animal life smaller than itself.

The amœba has no legs or other organs of locomotion, and yet it moves readily and quite rapidly from point to point. This is not so very remarkable, for many worms — the earthworm, for example — move without the assistance of legs. When the amœba desires to travel, it stretches itself out like a worm, and so flows itself along from point to point. The amœba seems to negative the popular saying that "water cannot flow up hill," for while it seems to be scarcely more than an animated liquid, it is able to flow up hill as well as down. Let the reader consider how surprised he would be to find, some day, a drop of water flowing straight up the side of a pane of glass, and carrying along with it minute specks of dust, fragments of insects' wings, little bits of cotton detached from clothing, and various other things. This is the remarkable appearance presented by the amœba as it flows along, continually changing its form.

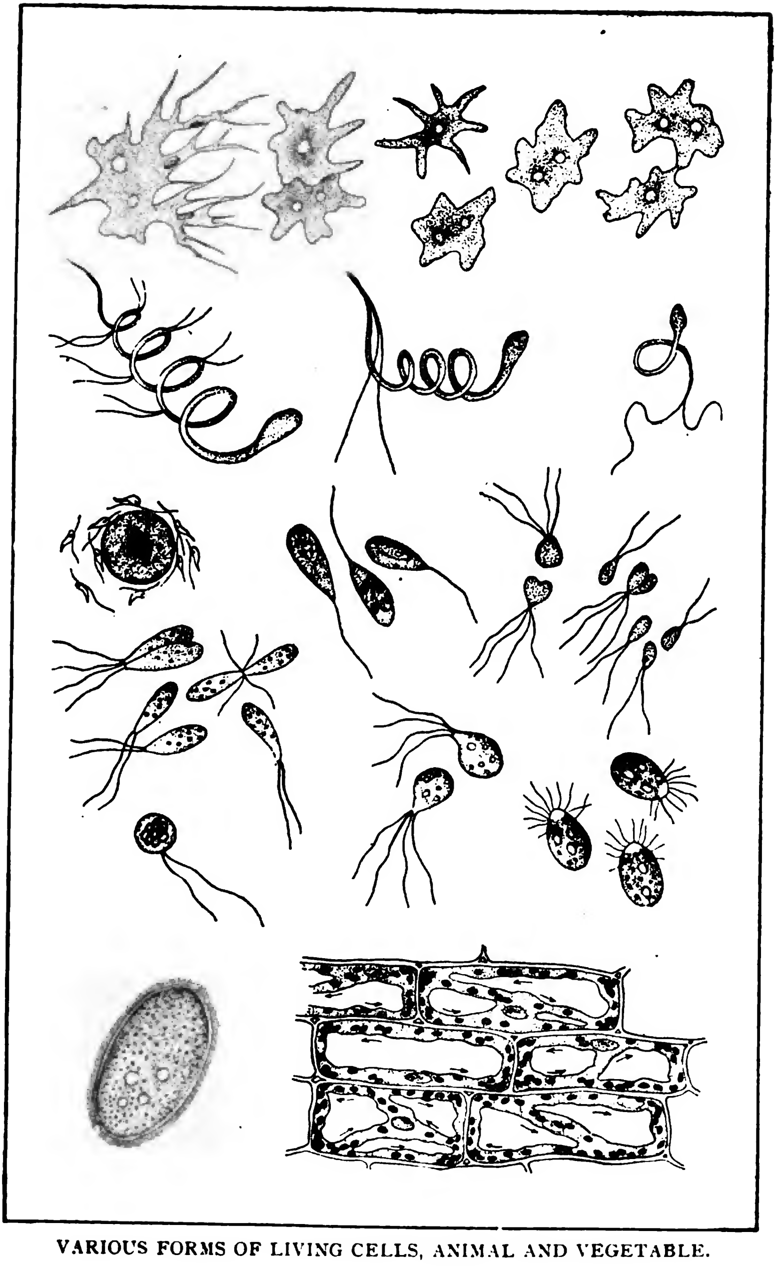
Feeling without Nerves, Movement without Muscles, Breathing without Lungs, Digestion without a Stomach.

The amœba has no brain and no nerves, and yet it appears to be able to feel, to will, to select, to pick its way among obstacles. It can contract like a muscle, feel and will like a

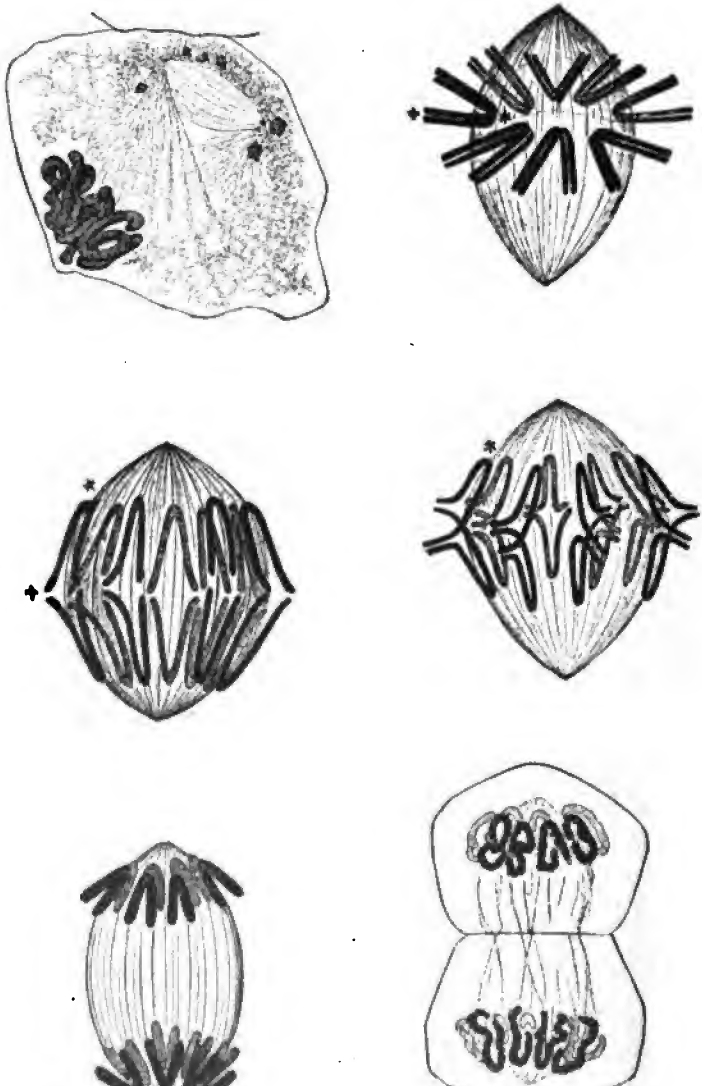
brain, and digest like a stomach, and yet it has none of these organs. It eats, breathes, works, and rests. It exhibits all the primary phenomena and functions of life. It is just as clearly and distinctly an animal as is a horse, an elephant, a whale, or a man; yet so minute that a hundred of them can swim about with ease in a drop of liquid which would hang on the point of a pin.

Larger Animal Forms.

The bodies of large animals and vegetables are not single cells like the amœba, but must rather be regarded as communities made up of many millions of cells, every one of which is an independent, living organism, but all more or less mutually dependent. The body might be compared to a swarm of bees, only that in the case of the bees, each one may exist, for a considerable time, separate from the rest if he chooses to do so. This is, to a small extent, true also of the animal body, as it is possible to remove a portion of the tissue from one animal, and graft it upon another animal of the same kind. Doubtless the reader is quite familiar with the ordinary process of grafting fruit trees, in which a bud of one tree is planted in a little slit cut in the bark of another tree. When the work is deftly done, the bud quickly becomes accustomed to its new home, readily becomes a part of the tree, and is nourished by it, but grows and bears leaves and fruit which accord entirely with the nature of the tree from which it was removed. It has become a practice with surgeons to borrow bits of skin from one person or several persons, to graft upon another person who has lost, by burning or some other accident, a large area of skin. An entire scalp has been reproduced in this manner after having been torn off by an entanglement of the hair in machin-



VARIOUS FORMS OF LIVING CELLS, ANIMAL AND VEGETABLE.



HOW CELLS INCREASE BY DIVISION. (KARYOKINESIS)

ery. Many cases have occurred in which a portion of a finger, when cut off, has been replaced, and has grown fast. Dentists have demonstrated that it is possible to replace diseased teeth by sound ones borrowed from some one willing to part with them. Many curious experiments of this nature have been made, by which it has been clearly shown that each portion of the body possesses its own life. This is due to the individuality of the minute cells of which the body is composed.

The Living Elements Which Form the Tissues.

There are many different kinds of cells in the body, just as there are many different kinds of people in a community. People differ in size, in color, in disposition, and in occupation. The same is true of cells. In the body, cells having the same occupation, the same work or functions, are generally grouped together, so that they may assist one another in their work. A group of such cells is called an "organ." This arrangement is the same as though all the carpenters, blacksmiths, lawyers, doctors, merchants, and other classes of people in a community were gathered into separate groups, so that all the individuals of each class might aid one another in their work.

Let us now study some of the different kinds of cells which work in the body, co-operating in the performance of all the varied functions of life.

The following brief description of the tissue elements is quoted from a text-book[1] in physiology by the author: —

"Each organ is composed of a few simple structures, called *anatomical elements*, or *tissues*. The whole body is made up of these elements, which are variously combined and

[1] "Second Book in Physiology and Hygiene," pages 11-13. J. H. Kellogg, M. D., Published by the American Book Company, New York City.

arranged to form the several organs, just as the wood, brick, stone, etc., of which a house is composed, are combined in various ways in the formation of the various parts of the house. A large part of the work of the cells of the body consists in the development and repair of these tissues.

Living Threads.

" In all parts of the body there are found long, white, thread-like fibers, which are very tough and unyielding. This is the kind of tissue needed to bind the different parts of the body together, and to make cords and protective coverings, for which purposes it is used. This is known as *white fibrous tissue.*

"Another form of fibrous tissue, somewhat similar to the preceding, but yellow in color, coarser, and capable of contracting after being stretched, very much like India-rubber, is known as *yellow elastic tissue.*

" The yellow elastic and white fibrous tissues together form in all parts of the body a finely woven meshwork, called *connective tissue.* This marvelously strong, though delicate structure is found in every organ of the body, binding together the various tissues, forming sheaths, membranes, bands, pouches, and coverings, and thus serving everywhere purposes of protection and support.

" In some parts of the body the meshes of the connective tissues are occupied by cells which are filled with fat. This is *adipose tissue.* This soft tissue forms cushions for delicate organs like the eye, rounds out the form, and serves several other very useful purposes.

"A very dense tissue, the hardest in the body, forms the chief part of the bone, from which it is known as *osseous*

tissue. This tissue has been experimentally shown to be stronger than the toughest oak.

"Some organs require a tissue having something of the rigidity of the bones, and at the same time, capable of yielding or bending a little under pressure. This requirement is met by the *cartilage tissue.* Most cartilages are connected with bones, which are themselves at first composed of this kind of tissue. In old age, many of the cartilages of the body become bony in character. This renders the chest rigid, and makes the bones brittle and extremely liable to injury by fracture.

Tissues Which Think, Feel, and Work.

"Those portions of the body which correspond to the lean meat of animals are made up of *muscular tissue.* Muscular tissue is composed of minute fibers, each of which is able to shorten and lengthen, somewhat as an earthworm contracts and extends its body when in motion.

"The brain and nerves are composed of cells and fibers possessed of properties the most remarkable to be found in living creatures. These cells and fibers constitute *nervous tissue.*

"Covering the whole surface of the body, and lining all its cavities, are found layers of curious cells. In one locality these cells assume one form, and in another a very different one. They are called *epithelial cells,* and the covering which they help to form is called *epithelium.*"

Some of the above, as, for example, the fibrous structures, are not really cells, but are the products of cell work or activity; they are the tissue elements which are builded by cells. All these different cells, and the tissues builded by them, "fitly joined together," constitute the living body.

Gland Cells.

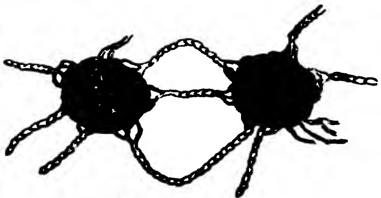
Among the most wonderful of the many millions of cells in the body are the so-called gland cells. These are found very widely dispersed throughout the body. There are many different kinds; they consist of cells of the same sort gathered together, having a common purpose, which is to form some peculiar substance for the carrying on of the work of the body. Several sets of these cells form saliva; others make gastric juice; others are found in the liver, making bile. Millions of little groups of cells, found in the skin, make sweat; others make fat, which oils the hair and the skin; others form peculiar substances which are thrown into the blood, and, circulating through the body, influence the processes of growth and nutrition to a wonderful extent.

Other glands separate from the blood poisonous substances which are formed in the body. The kidneys and the liver are especially active in removing from the blood these tissue poisons, together with those which may have been introduced with food or drink.

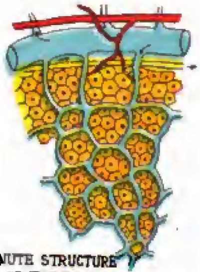
The accompanying illustrations show some of these different forms. In studying these cells and their activities, one is constantly led to marvel at the intelligence manifested, the faithfulness, industry, and perseverance displayed. In the action of a gland cell or a tissue-building cell, we see creative skill manifested. The same creative power is required to enable a cell to build the minutest thread of fibrous tissue as was required to make the first man.

A Physiological Puzzle.

Why do the salivary glands make from the blood an alkaline fluid, while the glands of the stomach make an acid fluid from the same blood? This is a question which the



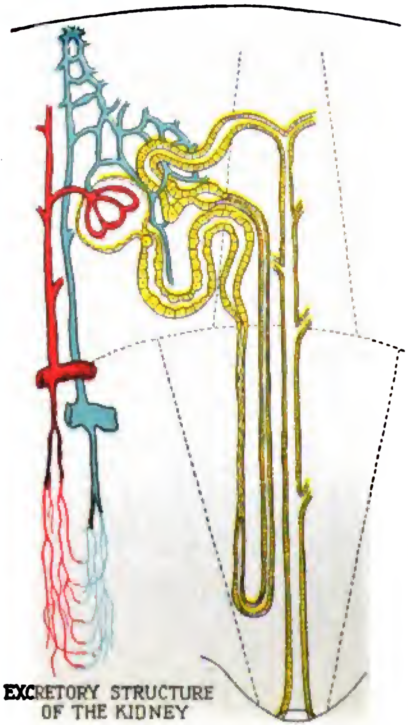
LYMPH GLANDS



MINUTE STRUCTURE OF THE LIVER

SALIVARY GLANDS

PEPTIC GLANDS



EXCRETORY STRUCTURE OF THE KIDNEY

wisest physiologist or the most profound philosopher can explain only by recognizing the active presence of infinite intelligence, not only supervising and controlling, but actually doing all the work that is carried forward by the various cells and organs of the body. That "God worketh all in all" is as true to-day as when Paul made the declaration nineteen hundred years ago, and it is the only explanation which the scientist can give of cell growth and activity.

The Blood Cells.

We will not undertake just now to make a complete study of the blood, but only call attention to the cells which are found in this wonderful, living fluid.

The blood owes its color to the vast number of amber-colored cells which it contains. In one of these cells is found a comparatively smaller number of so-called white cells, of which there are quite a number of different kinds. The red cells and the different kinds of white cells are shown in the accompanying cuts. The red blood cells are found only in the blood vessels, while the white cells are found outside, in the tissues, as well as in the blood vessels.

The wonderful functions of these cells, their intimate relationship to all the living processes of the body, as we shall later see, amply justify the Biblical statement that "the blood is the life."

The Temple Furniture.

The cells which we have studied constitute the brick and mortar of the body, the animated stones which are builded into the temple walls by the divine Architect. These cells,

structures, and tissues are variously joined together in the formation of parts which are adapted to the performance of special offices or functions in the body. The principal of these organs, and those to which our chief attention will be given in this work, are the following: —

The bones, which constitute the framework of the body, and serve as levers to be used in moving it about from place to place, and in performing various kinds of mechanical work. The bones have various important offices, which we shall consider later.

The muscles, which employ the bones as machines or levers in moving the limbs, in locomotion, in work, and in bodily activities of all sorts. Muscles also perform important offices within the body in connection with digestion and the circulation of the blood, and of other interesting functions, of which we shall learn.

The brain and nerves, which are the seat of intelligence, consciousness, and various sorts of sensations,— pain, touch, hearing, sight, etc.,— and which serve as a means of regulating and controlling all the organs and functions of the body.

The digestive organs, which dissolve the food, and prepare it to be passed on into the blood vessels, which distribute it to all parts of the body, and return the waste elements to the heart, from which they are sent to the proper organs for removal.

The lungs, which supply the air to the blood and remove carbonic acid gas.

The liver, the office of which is to make bile, aid digestion, and perform many other interesting functions, of which we shall learn.

The kidneys, to which is given the important duty of removing poisons from the blood.

The skin, which covers and protects the body, and, at the same time, acts as an outlet for poisons and a regulator of heat.

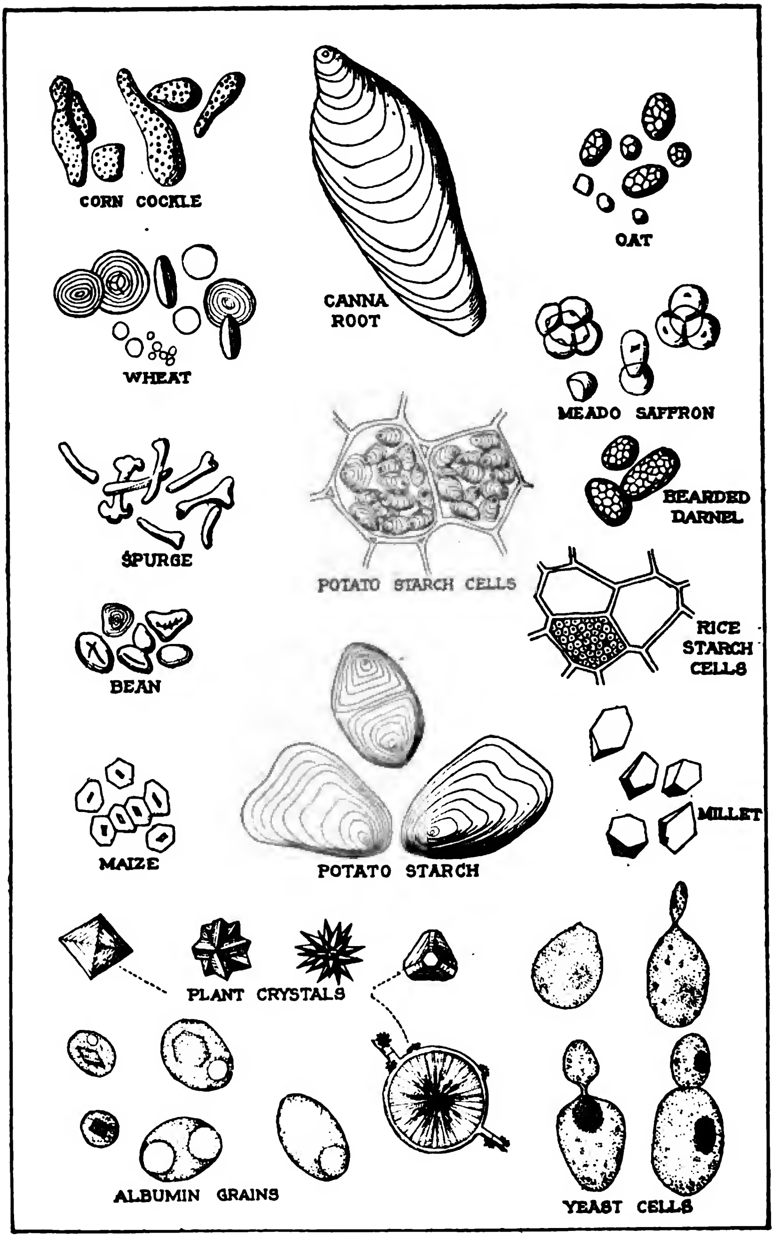
"Fitly Joined Together."

All these different parts and organs are the direct work, in every human being, as in every living form, of infinite power and intelligence. This fact is the true explanation of the marvelous symmetry and beauty and infinite perfection in details which the human body exhibits; nor need we wonder at the harmony and unity which are everywhere manifested in the body of a healthy human being. Let us notice the hand; observe the thumb and the several fingers — each has its own size and shape; there is a definite proportion and symmetry which is always preserved. All human hands have a decided resemblance, but two hands have never been made exactly alike. However like in general appearance two hands may be, a close scrutiny of the minute peculiarities detects a wide difference. It is only necessary to place the hand upon a sheet of paper covered with printer's ink, and then to press it upon a sheet of clean paper, and to compare the print thus made with the print of another hand, to make this fact clearly apparent. This method has been used as one of the most certain and perfect methods of identifying criminals and others. Every minute groove, wrinkle, and furrow is a permanent feature of the individual hand, and each has its purpose and its significance. (See cut.)

By what means is the symmetry and proportion of the different parts of the hand maintained in the midst of the continual change in the structure of the body, which is taking place hour by hour and week by week? The forefinger is

always a little shorter than the middle finger; the little finger is the smallest of all, and always remains the smallest, unless it becomes swollen or otherwise enlarged as the result of disease. What is said of the hand may be said of the various features of the face,— the two eyes, the ears, and all the corresponding portions of the two sides of the face and of the body. The preservation of the form and symmetry of the body in the midst of the perpetual change of matter which is constantly taking place, is truly a most remarkable fact, and should cause us to pause a moment, and consider by what means is maintained this wonderful stability in the midst of perpetual change. A certain physiologist has defined an animal as "a form through which a stream of matter flows." This is just as true of man as of other animals. An ordinary human being swallows, as food, from three to five pounds daily. The amount of food eaten, on the average each month, is practically equal to his own weight. According to this, an individual, when he eats his own weight every month, changes his body about twelve times a year. The matter taken in as food simply supplies the place of that which has been previously eaten, and discharged from the body. This rapid change of matter within the body would quickly result in a change of form, so that a person would lose his own identity, — would scarcely be able to recognize himself,— were such a change not prevented by the permanence of something within the man. In this permanence of form and feature we have a physiological proof of the existence within the body of some power superior to the material composition or substance of the body, which exercises a constant supervision and control whereby individual identity is maintained. This can be nothing less than the Power which builds, which creates,— it is God himself, the divine Presence in the temple. As

THE IMPRINT OF A HAND



STARCH GRANULES.

Lord Herbert has well said, "Whoever considers the study of anatomy, I believe will never be an atheist; the frame of man's body and the coherence of its parts are so strange and paradoxical that I hold him as the greatest miracle of nature."

Another writer has suggested, "God is not too far off, but too near, for us to see him." The apostle plainly says, "Because that which may be known of God is manifest in them; for God manifested it unto them. For the invisible things of him since the creation of the world are clearly seen, being perceived through the things that are made, even his everlasting power and divinity; that they may be without excuse." Rom. 1 : 19, 20. R. V. So, although God is so near that he is actually within us, a real, living, ever-present power, and yet physically invisible, we may clearly see him,— not by blind belief, but by the eye of faith.

Faith is not trust nor belief without evidence. God does not ask us to believe blindly, but rather to accept the overwhelming evidence which he has given us of his actual presence and his constant care. God gives us the proof of his existence, the evidence of his presence, in the marvelous phenomena of life which presents to us a perpetual miracle, a spectacle of creative power in actual operation.

We have not to look back many thousands of years to the beginning of the world's history to find evidence of divine creative skill and power. The Bible record of the creation of man out of dust is confirmed by the teaching of true science, especially the science of biology. We constantly behold the miracle of creation wrought out before our eyes in the growing of a human being from infancy to adult age, and the maintenance of individual identity from year to year. As before remarked, the creation of man involves, not simply the miracle of the making of the first man, but the making of every man, and not the making of the man once, but the continual process

of creating and maintaining him from moment to moment throughout his whole life. Man, without God, must instantly cease to be; he must instantly become a mere miscellaneous heap of dust.

The Unity of the Body.

It is interesting to note how this bodily unity and symmetry are maintained. This is not the proper place for a minute inquiry into this most interesting subject, but two or three important points may be noted:—

1. The whole body is associated through the nerves. The brain and spinal cord send out minute, living threads, which run throughout the body, dividing and subdividing until they reach every portion of the body, bringing under their influence every individual cell, with the exception of the floating cells found in the blood. Through the nerves, all the organs and cells of the body are kept in communication and in sympathy.

2. The blood affords another medium by which the organs and functions of the body are harmonized. The blood is being continually moved about the body, and brought back again to the heart. It is kept uniform in character and quality, so that all the tissues are supplied with the same quality of food. The quantity of food is regulated by the size of the blood vessels, which are proportioned to every part.

3. A third influence of a most wonderful character is brought into play,—every cell manufactures a substance peculiar to itself, which, being thrown into the blood, is brought into contact with and influences every other cell. This, although the most subtle, is perhaps one of the most powerful means by which the processes of growth and nutrition are influenced.

Certain cells, especially those found in certain glands, as the thyroid glands, the glands connected with the kidneys, and the sexual glands, exercise an astonishing influence upon bodily growth and symmetry. This is clearly shown by the influence of certain diseases to which attention will be called later in this work.

Evidence of the Divine Intelligence within the Body.

These functions are entirely independent of man's control. They are controlled wholly by the divine will, by divine voices within us saying continually, "This is the way, walk ye in it." If you were ever lost in the woods, you certainly have wished that you were possessed of that wonderful instinct which enables the homing pigeon to find its way back from distant and unfamiliar parts. The carrier pigeon has been known to take a straight line for home when set loose at a distance of hundreds of miles from the place where it has been reared. The bird, when freed, rises into the air to a considerable distance, describes a circle, and then traces its way home by the road over which it has traveled, perhaps closed in a dark box or under an anesthetic.

What is this instinct? To simply say that it is instinct affords no explanation. To ascribe to a blind, unreasoning faculty greater power than intelligence possesses, is absurd. The instinct which leads the pigeon to return directly to its home, enabling it to take the proper direction without the painful process of trying and failing many times before attaining success, is an exhibition of the highest intelligence,—an intelligence far beyond that required for ordinary mental processes. This homing instinct is not possessed by pigeons alone; many animals have the same faculty to a considerable degree. The horseman lost in the woods often drops the

reins upon his horse's neck, and trusts to his faithful beast to guide him to his destination. Here the intelligent man, the master, humbly bows before the higher intelligence of the horse, and is saved by the divine voice which the horse hears, but to which his own mind is deaf.

Instinct the Voice of God.

There are many lessons we may learn from the study of this higher instinctive intelligence of animals, as regards their physical well-being. Is it too much to believe that man once possessed this same sort of intelligence, so that he might know the way home as well as does the pigeon, the horse, or the cat? Is it not more than probable that man has lost touch with the higher intelligence through perversion, because of his neglect to comply with the laws of his being,— in other words, that he has lost his connection with God to a great extent? An intelligence which can guide a stray pigeon home without the aid of landmarks of any sort, or notes of any kind taken by the way, is so far above anything known of human intellectual feats that we must believe it to be a manifestation of divine care. Instinct is simply God speaking to the creature, guiding it in those things which require greater wisdom than that of either animal or human mind.

A mariner at sea, without chart or compass, without sight of sun, moon, or stars, driven by changing winds, soon finds himself absolutely lost; and yet the pigeon, carried five hundred miles to sea, in a box, if let loose, is able to show the mariner the way to the shore, or may carry a message home for him. Such intelligence, such power, is superhuman, but not supernatural; for it is as natural to the pigeon as it is unnatural to the man; but it cannot be doubted that it represents one of the glorious faculties which man has lost through sin,

and which, through obedience, it may be possible for him to reacquire.

But although man has lost his homing instinct, he still has divine voices within, which speak to him with the same certainty of help as does the homing instinct of the bird. Thirst, for example, is the divine call for water, the invitation to drink from the fountain of life; for pure water is the stream which, coming out from the throne of God (God's throne is in the heavens), turns the wheels of life. Thirst says to the man whose blood is getting thick, whose life stream is running low, "Drink and live."

Hunger is another divine voice, speaking in tones which are clearly understood, "Eat ye that which is good." "Take, eat, this is my body," and, "As oft as ye do it, remember me," said Christ. How often when we eat do we forget the source of our life, our light, our being.

Food furnishes the substances which water dissolves and carries to the hungry tissues. In food and air are locked up the divine forces which replenish the stores of life within the body; so hunger says, "Eat and live."

The thirst for air is one of the most imperious of all human instincts. This is another divine voice, inviting and commanding us to supply a pressing bodily need. Without the constant prompting of these inward voices, how soon would man cease to give himself the proper care! He might neglect to eat, to drink, to breathe, until the life forces would fail. We often see this illustrated in cases of disease. In some forms of insanity the hunger voice is stifled, the patient refuses to eat; he has no hunger, and food is loathsome to him; he must be fed by means of a tube passed into the stomach through his mouth or nose. Such cases are rare, but another form of insanity is exceedingly common,— the subject recog-

nizes the hunger voice, but refuses to satisfy it by natural means, and, instead, supplies things which are not food. Said the great Teacher, "If your son asks for bread, will you give him a stone?" The body calls for bread, for life-giving food, but how often we supply, instead, such indigestible, unwholesome rubbish as pickles, green olives, fried foods, and various abominable mixtures which bring into the body death rather than life.

How often, too, the voice which calls for pure, life-giving water is insanely answered by such disease-producing drinks as beer, whisky, wine, tea, or coffee, and the like.

Pain may be regarded as a beneficent voice, a divinely implanted instinct in which God speaks to us to warn us that danger is at hand; that the integrity of the body is threatened; that law is being violated. Pain is an importunate appeal, fairly shouting in the ear of the transgressor, "Turn, turn, sinner, for why will you die?" Pain is not punishment, but a divine fog-horn warning the wrongdoer off the perilous coast of transgression.

Fatigue, a desire to sleep, is another divine voice which appeals to the consciousness in behalf of bodily needs, rest from activity, the closure of the eyes, the withdrawal of the mind and body from all the excitements and labors of waking life, so that the worn, overheated, creaking wheels of life may be cooled and regulated, lubricated and repaired, by means of God's "sweet restorer," natural sleep. It is during sleep that the processes of growth and repair chiefly take place. Children grow during sleep more than when they are awake. Plants as well as animals grow most rapidly during the hours of darkness, gathering food material, like animals, during the day, but appropriating this material during sleep. This is the divine plan for all animated nature.

The call to awaken from rest is as truly a divine voice as the call to sleep. It seems easy enough for one to go to sleep, but when one is once asleep, how can he awaken? Isaiah understood this physiological truth better than the best of modern physiologists, who confess their utter inability to explain the phenomena of sleep and awakening. The prophet said, "He wakeneth me morning by morning." Isa. 50:4. It is God that calls us to sleep, and it is God that awakens us when the purposes of sleep have been accomplished, sending us off on our mission of activity, to work, each in his own sphere, to witness for Him who is the strength of our life. 1 Sam. 22:23.

There are many other divine voices which are constantly saying to us, "This is the way, walk ye in it." Isa: 30:21. We have not space to consider this phase of our subject further at this point.

If we have thoughtfully and carefully considered each of the topics thus far presented, we must be prepared to exclaim with the psalmist, "I am fearfully and wonderfully made" (Ps. 139:14), and to agree with the sentiment expressed by a master mind who wrote,—

"What a piece of work is man!
How noble in reason! How infinite in faculty!
In form and moving, how express and admirable!
In action, how like an angel! In apprehension, how like a god!
The beauty of the world,—the paragon of animals!"

—*Shakespeare.*

The Maintenance of the Temple

THE most substantial temple ever built by human hands, the strongest machine ever constructed by man, begins to decay and steadily progresses toward destruction from the moment it is completed. Repairs must be constantly made to render the destructive process as slow as possible. This is, in a sense, also true of the living temple, the body. A machine deteriorates much more rapidly than a building, for the reason that it works. Work involves "wear and tear," — the consumption of energy, the destruction and necessary repair or replacement of the worn parts. The living temple is both a house and a machine; it works, hence it wears, and the rapidity of the wearing-out process is so great that the entire temple is rebuilded many times during a long life. It will be profitable for us to consider some of the sources of this wear and tear by which the temple is consumed.

The Vital Fire.

The most active of all consuming agencies is fire, or combustion, chemically termed oxidation. There are various forms of combustion. What is ordinarily spoken of as "fire" is an active burning, accompanied by a fierce, devouring flame. When combustion is less active, the heat is less intense, and there may be no visible flame. It is by this sort of combustion that a dead tree, lying upon the ground in the woods, is gradually consumed. The amount of heat produced by the burning of a tree is just the same, whether it rots in the forest or is burned in a furnace, though in the furnace it is given off in a much shorter time.

The living human body is always warm. Its temperature is constantly maintained at about 100°. In some animals, as certain birds, the temperature is higher, even as high as 110° to 112°, while in animals said to be cold-blooded, as fishes and frogs, the temperature varies with that of the water or air with which the animal is in contact, but in cool water the temperature of the animal is always a little above that of the surrounding medium.

The Source of Bodily Heat.

What is the source of this *heat,* called "animal heat," which is always produced in the living animal body? It is the vital fire or combustion carried forward within the body under the control of the presiding Intelligence which carries forward all the bodily functions, and cares for all its needs.

The amount of heat produced by the body has been estimated to be sufficient to raise two and one-half pints of water from freezing to the boiling point, every hour, or to boil seven gallons of ice water every twenty-four hours. The body gives off about the same quantity of heat hourly as does a foot and a half of one-inch iron pipe filled with steam. This is about the same amount of heat as would be produced by the burning of two thirds of a pound of coal, although, to produce the same result, a much larger amount of coal would be required; as a large part of the heat produced in the burning of coal for heating purposes is wasted in passing up the chimney, or by radiation to surrounding objects.

As another comparison, we may say that the amount of heat generated in the body is about the same as that which would be produced by a small kerosene lamp capable of burning two thirds of a pint of oil every twenty-four hours, or by the continuous burning of a couple of ordinary candles.

Wherever heat is produced, something must be consumed, consequently the vital fires consume the body just as burning consumes a candle or the fuel in a stove. We see, then, that the poetic reference to life as a "flame" is, after all, a scientific expression of a fact. Life is truly a flame, a consuming fire, and the body is the substance which the flame consumes, especially the following: —

"Life is a pure flame, and we live by an invisible sun within us."— *Sir Thomas Browne.*

How this burning is carried forward is one of the so-called mysteries of science which no one has undertaken to explain. The more we know of the intricate processes of nature, the deeper does the mystery become, until we recognize God as the explanation of it all, not a God far away, directing and controlling blind forces, as a naval commander controls the movements of the gunboats which compose his squadron, by messages sent by signs and otherwise to the officers in command of the several vessels, but as the one great source of power, the fountain of all life and energy, the real actor in all the operations of the universe. The fire which burns in the body consumes the food as a furnace consumes fuel, while at the same time leaving absolutely uninjured the most delicate nerve filaments, the most fragile threads of living protoplasm. This fire is not such a burning as man may kindle, an ordinary chemical combustion, a destroying flame, but is a sacred fire ever burning in the presence of Him who presides in the temple, maintained by his own life and energy so long as the temple stands. When at death the tottering walls of the temple fall, its altar fires are quenched, and only ashes remain.

Bodily Wear and Tear from Work.

Another most important source of bodily waste is work. Work always involves the consuming of substance, just as heat does. The locomotive cannot pull its train of cars without the consumption of coal, and the locomotive which consumes the most coal pulls the largest train, other things being equal. The amount of fuel consumed is always proportionate to the amount of work done. In the case of the locomotive, the fuel is carried in a special receptacle, the "tender." In the Living Temple, the body, the temple itself is consumed by its work. The amount of work which the body is capable of doing daily has been carefully estimated, and has been found to be equivalent to the lifting of nine hundred tons one foot high. More than one seventh of this work (124 tons) is performed by the heart in circulating the blood. About an equal amount of work is performed in the movements of breathing. The balance of the work is done by the muscles of the limbs and trunk. To perform this work in ten hours, a man would have to lift more than forty pounds per second, or eleven pounds four feet high per second, or his own weight a foot high every three seconds. This work, performed by the legs alone, would require a man to walk more than one hundred miles in twenty-four hours, or to lift himself up a perpendicular ascent of five miles.

Careful experiments have shown that the vital combustion in the work of the body consumes it at the rate of one eightieth of its weight every twenty-four hours. At this rate, the entire body would be consumed in eighty days; but it is not possible for life to continue until the last particle of the body's substance is consumed. Observations have shown that death occurs when about half the weight of the body has been consumed, or at the end of about forty days.

Divine Stores of Life and Energy.

From the above, it is clearly evident that life can be prolonged only by the constant supply of living substance to take the place of that which is consumed in work and heat production. A beneficent providence has provided for this imperative need in the substances which are commonly called "food," especially those furnished by the vegetable kingdom.

Just here, it will be well for us to pause a moment, and consider the important and characteristic difference between plants and animals. The plant is a storehouse; the animal, a living machine. The plant gathers energy; the animal expends energy. The plant derives its energy from the sunlight. It is only under the influence of the sun's rays falling upon the leaves and the bark of the plant that the energy locked up in the air and earth and water is molded into forms which render it available for use in the animal or the human body; in other words, it is the creative, miracle-working power of the sunlight which produces those substances which are capable of being received into the body, or, being builded into the walls and pillars of the myriad delicate and intricate structures of the wonderful temple which we call the body. The light which comes from the sun is energy,—not simply sun energy, but divine energy. The great apostle enunciated this basic, physiological, and theological fact when he wrote, "God is light." 1 John 1:5.

Stored Sunlight.

The light does not simply fall upon the tree, it enters the tree, it becomes a part of the tree.

We have proof of this in the fact that we have only to raise the temperature of wood a few hundred degrees to see the light shine out again the glowing brilliance of coal and

flame. We have a somewhat more complicated, but none the less true, illustration in the electric light. The plant which grew and stored sunlight hundreds of years ago is burned in the furnace of a steam boiler; an engine is set in operation, which propels the dynamo. The dynamo sends out an electric current, which heats a filament of carbon in a glass globe, and in the glowing spiral we see shining out the veritable sunlight which, ages ago, fell upon the huge ferns and pines from which the coal was formed. A lump of black coal, then, is a storehouse of sunlight, only needing the application of heat to cause the light to shine forth with all its original warmth and brightness.

Every vegetable product is such a storehouse. Every fruit, every seed, every nut, is a little bundle of concentrated light stored until it is needed for use in the growth and development of a plant, or for the service of our temple bodies, or to furnish heat and energy to some member of the animal kingdom. It is just as impossible for an animal to gather in stores of life and energy from the original sources of supply — sunlight, the earth, the air, as it is for a vegetable to make use of or to expend energy in work. Birds fly. Some vegetables or vegetable seeds have wings, but they are only driven by the wind; they do not fly. Flowers have lips, but they do not speak. Trees have arms, or limbs, but they move only when swayed by the breeze. Vegetables store energy; animals expend it. The plant is a storehouse; the animal a living, divinely devised and constructed machine.

Light Divine Energy.

It is a significant fact that in the beginning of things, one of the first acts was the sending forth of light: "And God said, Let there be light: and there was light." Light is the

vehicle of energy to all living things; it is the means by which God enters into animate nature. The glorious sunlight which garnishes the sky, tints the flowers, paints the rainbow, and glistens in the dew, is creative power at work. It is this glorious light which vitalizes all living things by its warmth. It is a propelling power in the universe. It is the light, with its accompanying heat, which lifts the water from the lakes, rivers, seas, and dew-moistened grass and leaves to form clouds, and thus maintain the never-ceasing flow of life-giving water which issues from the throne of God (the heavens, Rev. 22:1) in falling rain and dew.

Light is, to man, one of the most powerful of all vital stimulants. It brightens the temple as it shines upon its walls; it heightens its colors and stimulates its activities; but there is no provision in the body temple, as in the plant, whereby the sunlight may be captured, held, and stored for future use. Light stimulates the consuming activities of the vital machine. This it does by increasing the appetite and the digestive power. Appetite is nothing more than a disposition to draw upon nature's storehouse for a new supply of living substance.

The reader must not consider that the statements above made or the language employed are intended to be considered as in the slightest degree figurative. It is the purpose of the author to express his thoughts in the plainest and most literal language at his command. We cannot understand nature, neither can we understand God, who speaks to us through nature, unless we lay aside all prejudices and preconceived notions, and turn a deaf ear to that twice-confused Babel of tongues, systematic theology, with its paradoxes and mysticisms and absurd hypotheses and reason-baffling tests of faith, and sit, as a humble listener, at the feet of him who says,

"Thine ears shall hear a word behind thee, saying, This is the way, walk ye in it." Isa. 30:21. The great Teacher is speaking to us to-day just as truly and as really as when, clothed in human form, he walked the earth nineteen hundred years ago. But, to receive the thought of him who said, "I am the way, the truth, and the life" (John 14:6), we must empty ourselves of those hindrances to the receiving of truth which are merely man-made inventions, and which obscure rather than assist spiritual insight into God's thought.

The Bread of Heaven.

We see, then, that food and the act of eating are divinely appointed means of supplying the body temple with living substance which may take the place of that which has been consumed. But only those things can be so employed which are *living* substances, or the product of vital activity; in other words, stored sunlight, for this is the only possible source from which the body can derive heat and energy. Substances from which the light has been given off can be of no service. We see, also, that the purpose of eating cannot be the mere gratification of the appetite, the enjoyment of the agreeable sensation which food produces in the mouth and throat as it passes through them, but that it has a higher purpose,—the illuminating and energizing, the vitalizing and renewing of the living substance of the body, in which and through which, God's life and energy are displayed. Nevertheless, eating is agreeable, and it is right that the taking of food should be enjoyable, but only for the reason that the beneficent Creator has so arranged that his ways are ways of pleasantness, and all his paths are peace (Prov. 3:17), when man walks after the divine order.

The Elements of Food.

Let us now study, with some care, the particular character of the substances which are adapted to serve as food for man. The purpose of food being to rebuild a constantly wasting temple,— to replace with fresh, new, light-filled substances those which have given forth their energy and life to the body, and hence have become darkened, and no longer fit to dwell in a body divinely ordained to be "full of light," it is evident that the quality and the quantity of food must be suited to the bodily needs. If we study the body, we find that it needs several different sorts of elements. These are specially the following:—

1. First of all, we need material which may be quickly built into the body, and which may be as easily and quickly converted into heat and energy. This exists in the food in the form of sugar and starch, and in the body in the form of glycogen, a sort of animal starch. Glycogen is found chiefly in the liver and the muscles.

2. There is also found in the body a considerable amount of substance from which heat and energy may be readily derived, existing in the form of fat, and which is stored up, often in large amounts, to be drawn upon when required by emergency. The fat of the body serves the same purpose as the coal in the tender of a locomotive, while the starch and sugar correspond more closely to the coal already in the furnace.

3. A third important class of substances found in the body are those which form an essential part of the muscles, nerves, glands, and all living cells. These are known by the general name of albumins, or proteids. These substances correspond to the iron, brass, and other materials out of which the locomotive is made.

4. Combined with the third class is a small, comparatively insignificant, yet essential class of substances, commonly called salts. These are represented by the ashes left when the animal body has been burned. These salts do not exist in the body as mineral substances, nor in the form in which they are found in the ashes of an animal, but in an organized or living form, the exact nature of which scientists have not yet been able to discover.

An examination of substances which are capable of maintaining life, or which may serve as food, shows that they contain all these various elements, which may be briefly enumerated as starch, albumin, fats, sugar, and salts.

Starch.

This, the most abundant of the food elements, is found in vegetables, grains, in most seeds, and in nearly all vegetable foods. It is also found in green fruits, but not in ripe fruits, and, with a very few exceptions, is not to be found to any considerable extent in nuts. Grains contain starch in larger quantity than any other element. More than half their weight consists of starch. Every species of grain, and every vegetable containing this element, has its own particular variety of starch, but, in general, starch consists of little granules, each made up of several layers of a peculiar substance which is possessed of most remarkable properties, and undergoes the most interesting changes in its entrance into and sojourn in the body. The accompanying illustration shows different forms of starch granules, found in the common grains and vegetables.

Sugar.

This remarkable food substance, found in nearly all fruits, is also found to some extent in vegetable foods. There are many different kinds of sugars. Sugar furnished by the sugar cane, the beet root, and the sap of the maple tree, is known as cane sugar. The sugar of fruits is fruit sugar, or levulose. A peculiar sugar produced in the sprouting or malting of grain, is known as maltose. Beer is produced by the fermentation of this sugar. Another form of sugar, commonly known as glucose, is artificially made by treating starch with sulphuric acid. This process is employed on a large scale, at the present time, in great factories, and produces a very cheap, but inferior sort of sugar, which cannot be safely substituted for the natural products of the vegetable kingdom.

Sugar, though very unlike starch in appearance, is almost identical with it in composition, and serves practically the same purpose in the body, since starch is, by the processes of digestion, made into sugar,— maltose,— as we shall see later.

A sweet substance found in milk is known as " milk sugar."

Dextrin.

Another substance, closely resembling both starch and sugar, is dextrin; it differs from starch in the fact that it is readily soluble in water, while starch is not.

Fats.

Oils, or fats, abound in certain foods; they are especially abundant in nuts. They are also found in the olive, a fruit, and abound in certain other seeds, as the peanut, and soja bean of Japan. Fats are found only in small quantity in the grains, with the exception of corn, which con-

tains about 5 per cent of fat, and oats, which contain 7.8 per cent. Fats are almost wholly absent from wheat, rice, barley, and rye. Fats are also found in animal substances, but in a different state from that in which they occur in the vegetable kingdom. In the vegetable, fats occur in the form of very minute particles, or an emulsion. If, for example, nuts are chewed in the mouth, a cream-like substance is produced; this is due to the fat emulsion present in nuts. When a piece of fat meat is chewed in the mouth, an oily substance is produced; this is not an emulsion. Emulsions differ from fat in the ordinary state in the fact that they readily mix with water. If the hands are smeared with oil, soap is needed to remove the fatty substance, for the reason that soap is capable of forming an emulsion, which may be readily washed away by water. We shall see the importance of this fact in the consideration of the subject of digestion a little later on.

Albumin.

Albumins, like fats, are found abundantly in both vegetable and animal substances; but food albumins proper are chiefly found in vegetables and in eggs. If a portion of wheat flour is mixed with water, and allowed to stand for two or three hours, and then washed upon a sieve under a stream of water, the water which first flows away will be milky, but after a time, when the mass has been considerably reduced in size, there will be left an elastic, rubber-like substance which no longer gives to the water a milky appearance. This is known as gluten. Gluten contains albumin and various allied substances, one of which is vegetable glue, or gelatin, a substance similar to the well-known gelatin or isinglass. Elements practically identical with gluten, although lacking in vegetable glue or gelatin, hence a differ-

ent product physically, are found in all cereals, very abundantly in nuts, and in large proportion in peas, beans, lentils, and other leguminous seeds. This element is almost entirely lacking, however, in fruits, and is present in only minute proportions in vegetables.

A specimen of almost pure animal albumin is to be found in the white of an egg. As we have already learned, the muscles, nerves, brain, glands, and other living structures of the body, consist chiefly of albumin, or proteid substances. But animal albumins, or proteids, with the exception of those found in eggs, differ from those found in vegetables, in the fact that they constitute tissues, or working parts; they are a part of the animal machine and intended to do work, while the albuminous substances found in seeds, like those found in eggs, are stored albumin especially prepared and intended by nature for food. The albumins of the egg are intended to serve as food for the young, growing animal until it is able to procure food for itself. The albumin found in seeds serves the same purpose for the young plant, or for animals for which the seed may serve as food. The albumin of tissues, meats of all sorts, has been used already by the animal, and are no longer food albumin, but tissue albumin.

It is reasonable to suppose that albumins especially prepared by an all-wise Providence for use as food should be better adapted to this purpose than albumins which have once served as food, and have been constructed into a machine for the use of food stuffs in various kinds of work. A simple illustration will perhaps make this fact clearer. The man who builds a locomotive employs iron which has been especially prepared for making the different parts of this wonderful machine. A man who builds a sewing machine naturally uses iron which has been especially prepared for the

sewing machine. It is evident that the sewing-machine maker could more easily construct his delicate machine from materials especially prepared for his use than from the odds and ends of rusty bars and sheets, bent and broken bolt, nuts, ets., left behind in a worn-out or smashed-up locomotive. Divine Providence supplies to each animal food stuffs adapted to its use,— the natural products of the vegetable kingdom. It is reasonable to suppose that these are best adapted to the use of each individual animal. Every element needed by the animal is provided by the vegetable kingdom.

It must not be forgotten that material deteriorates in use. No carpenter would ever be expected to be able to build as good a house out of the timbers, boards, window frames, doors, etc., collected by tearing down one or several old houses, as if constructed from brand-new material. It is possible that some of the old doors and windows might be of exactly the size needed for the new house, so that if they were incorporated into the building, less work would be required; but the quality would certainly be sacrificed. This principle is of value in determining the relative merits of flesh and vegetable substances as foods in a diet for man. Rusted steel is deteriorated steel. A worn and brittle iron rail has lost the value it possessed when fresh from the hand of the foundryman. So the albumin of flesh is used and deteriorated albumin, second-hand food stuff, at the best. Albumin found in vegetable foods, such as the gluten of wheat and the legumin of peas and beans, is food albumin. It has been especially prepared and stored for use as food, and hence is better prepared for assimilation than is that which has been once used as food, by an ox for example, and converted into tough, sinewy muscle tissue.

Peptogens.

These are remarkable substances the nature of which has not yet been fully determined, but which are found in all foods. Peptogens have the wonderful property of causing the stomach to produce gastric juice. Foods which contain no peptogen are treated by the stomach like wood, as saw-dust, for example, or any other inert or indigestible substance. Some peptogens stimulate the formation of acid, and others encourage the formation of pepsin. Certain foods are deficient in peptogens. This is especially true of potatoes and other starchy vegetables. Ripe fruits and dextrinized grains contain peptogens in abundance. Peptogens also abound in broths and soups prepared from peas, beans, and lentils, and in meltose, or malt honey.

Man's Natural Dietary.

While it is true that various food elements required for use in the body may be obtained from both the animal and the vegetable kingdoms, it is by no means to be supposed that it is a matter of indifference from which source their food is derived.

Granting, then, that man's natural dietary is derived from the vegetable kingdom, we must still recognize the fact that all vegetable products are not equally well adapted to support human life and activity. In Gen. 1:29 we read, "Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat." The most thoroughgoing scientific research upon this question leads most certainly and unequivocally to the conclusion that the dictum of Holy Writ in relation to man's diet is the expression of a profound biological fact. Many eminent authorities

who have studied this question exhaustively have borne testimony to this fact.

The most positive confirmation of these views is to be found in the undeniable fact that a large part of the human family have, from the earliest times, subsisted upon foods of vegetable origin, chiefly of fruits, grains, nuts, and other seeds. At the present time, these substances constitute the principal sustenance of at least two thirds of the entire human family. The three hundred millions of India subsist almost exclusively upon rice and *dahl,* a species of lentil, with a little oil, and sometimes melted butter, but preferably the oil of sesame or some other seed. The same is almost equally true of the four hundred millions of China and Siam, and the scores of millions which occupy the central portion of the Dark Continent, who live chiefly upon fruits and nuts and other natural vegetable products of the forest. The cocoanut, the plantain, and the banana form a very large proportion of the dietary of the natives of Central America, the West Indies, and the widely scattered islands of the Pacific. Only Europeans and a few savage tribes subsist to a very large extent upon animal foods, and it is perhaps true that coarse vegetables, such as the cabbage, spinach, celery, and other woody stuffs, are more generally used by Europeans than by any other class of the human race, with the exception of a few degraded and belated tribes who, for lack of other better food, live upon roots, insects, and reptiles, and are reduced to a state but little above that of the beasts of the field.

One of the first evidences of gastric enfeeblement is the inability to digest vegetables. Cereals, when properly cooked, are very quickly digested. Fruits are served up by the hand of nature already digested, requiring only thorough mastica-

tion to secure their rapid passage through the stomach to the absorption reservoir below. Nuts, an extremely concencated, so that their firm structure is reduced to a creamy paste. Vegetables, however, like meats, are slow of digestrated food, are readily digestible, when thoroughly mastition, because of the large amount of waste and indigestible substance which they contain.

It should be noticed, also, that fruits, grains, and nuts always harmonize together in almost any sort of combination that can be devised, whereas there is often a disagreement between vegetables and other food substances, particularly fruits. This is certainly a strong hint that vegetables proper were never intended for human dietary. It should be understood that by "vegetables" is intended those coarse, woody substances other than the seeds or seed-bearing portions of plants. This class includes buds, as the cauliflowers; stems, as celery, asparagus; underground stems, as the potato; roots, as the turnip, beet, carrot, and parsnip; and leaves, as cabbage, lettuce, and spinach. Of these various products, the potato most nearly resembles the cereals, and it may be said in its favor that its starch is even more digestible than the starches furnished by the cereals. The question of cookery, however, must be taken into consideration. There is no doubt that thorough cooking wonderfully increases the digestibility of vegetables, so that by the aid of this process, which is a sort of predigestion, we are able to make use of many food substances which otherwise could be eaten only at the risk of very great injury.

The Miracle of Digestion

DIGESTION is the wonderful process by which food stuffs are changed into blood and then into living tissues. Although these foods contain all the elements which are found or needed in the body, these cannot be directly appropriated. The food substances must be rendered fluid before they can be taken into the blood and circulated to the tissues. Then by the tissues the liquid food conveyed by the blood is again transformed into solid and semisolid substances.

The Organs of Digestion.

The processes by which these changes are affected are as truly miraculous as anything which the imagination can picture; but before we can undertake the study of these remarkable processes, we must know something of the form and structure of the digestive organs, in which these changes take place. These are essentially five, and are arranged along a tortuous tube, called the alimentary canal. They consist of the *mouth,* the *stomach,* the *liver,* the *pancreas,* and the *intestines.*

The *mouth* contains the *teeth* — twenty in the child, thirty-two in the adult — and the *tongue;* and there are connected with it several pairs of glands, called the *salivary glands,* which form an alkaline secretion, the *saliva.*

The mouth is connected with the *stomach* by the narrowed upper portion of the alimentary canal, called the esophagus, or gullet. The stomach is a pear-shaped organ, holding

about three pints, or three fourth of an ounce for every inch of the individual's height.

The stomach is lined by *mucous membrane,* and is covered externally by a delicate membrane, called the *peritoneum,* and its walls are chiefly made up of muscular fibers, which give to it great contractile power. In the walls of the stomach, opening into its cavity, are a great number of minute glands, which pour out an acid fluid. Other glands are active in the formation of *pepsin,* which, combined with the acid liquid, forms the *gastric juice.*

Lying at the back of the stomach, and partly overlapping it, is the next important digestive organ, the *liver,* which forms a liquid, called the *bile,* and discharges it through a small tube into the alimentary canal just below the stomach.

Lying just behind the stomach is another very large gland, the *pancreas,* which forms another remarkable fluid, the *pancreatic juice,* which is discharged into the intestine through the same opening through which the bile enters.

The *small intestine,* the largest and most important of all the digestive organs, is the narrow portion of the alimentary canal, some twenty-five feet in length, which connects the two dilated portions, the stomach and the colon. Its walls are everywhere thickly studded with glands, which pour out mucus and other fluids, and there are also present millions of minute projections, which serve to increase the extent of the absorbing surface.

The colon, which forms the lower five feet of the small intestine, is not a digestive organ proper, but is a reservoir in which the food is stored up for a short time to allow opportunity for complete absorption of the digested portions.

Five Food Elements, Five Digestive Organs, Five Digestive Fluids.

From the above it appears that there are *five digestive organs* and *five digestive fluids.*

Before beginning the study of the several digestive fluids, let us recall that there are five food elements; namely, *starch, albumin, fats, sugar,* and *salts.* There are likewise five digestive fluids; namely, the *saliva,* the *gastric juice,* the *bile,* the *pancreatic juice,* and the *intestinal juice.* It is important to understand the relation of these several digestive fluids to the different food elements which it is their duty to reduce to a liquid state, thus preparing them for absorption into the blood vessels and circulation to the needy tissues.

Nothing in all the realm of nature is more remarkable than the transformation which takes place in the several food elements under the influence of the several digestive fluids. This wonderful alchemy we are now prepared to study.

What the Saliva Does.

If a hard bread crust is chewed for some little length of time, it becomes decidedly sweeter than when introduced into the mouth. This is due to the digestive action of the saliva, which possesses the remarkable power of converting tasteless starch into sugar. To demonstrate this it is only necessary to add a teaspoonful of saliva to a tablespoonful of paste prepared from cornstarch. Thoroughly mingling the saliva with the starch paste, one at first observes no change; but if the mass is kept warm at a temperature of about blood heat, but a few minutes elapse before the thick paste has become almost as thin as water, and within a very short time a sweet taste may be readily detected.

It is the business of the saliva to digest starch by convert-

ing it into sugar. This sugar is of the variety known as maltose, which is also found in malt, and is the result of the digestive action of diastase, a substance which, like the saliva, is capable of changing starch into sugar.

The process of starch digestion is not confined to animals. In many plants there are digestive principles capable of transforming starch into sugar. This change always takes place in the ripening of fruits, transforming the starch of the green apple, for example, into the sweet, wholesome flavors found in the ripe fruit. By a similar process, the starch stored up in the roots of the maple tree in the fall is in the spring converted into sugar, and carried up in the sap to furnish material for the production of new buds and leaves so setting in operation the vital processes of the plant. It is in this way also that the honey of plants is formed, to be deposited in the flower cups from which it is collected by the industry of the bee.

The digestive action of the saliva differs from that of vegetable diastase, however, in the fact that it is capable of acting only upon dextrin or cooked starch, whereas vegetable diastase acts upon raw starch, though much less rapidly than upon starch which has been cooked. This fact has an important bearing upon the hygiene of digestion.

The action of saliva begins in the mouth, and continues while the food substances are retained in the mouth, and may proceed for thirty to forty minutes after the food is swallowed into the stomach, or until a considerable quantity of the acid gastric juice is formed. The saliva being a naturally alkaline fluid, its activity is checked by the presence of acid substances; hence the digestive action of the saliva in the stomach ceases as soon as the gastric juice is secreted in sufficient quantity to render the saliva acid.

The Work of the Gastric Juice.

About seventy ounces of gastric juice are formed by the glands of the stomach daily. This fluid, unlike any other of the bodily secretions, is intensely acid. It is believed by chemists that the acidity is due to the presence of hydrochloric acid, an intensely acid substance commonly known as muriatic acid, or spirits of sea salt. The acid of the gastric juice probably differs from the mineral acid, which, however, it very closely resembles in many respects.

The gastric juice contains, in addition to acids, a quantity of pepsin, which, acting with the acid, dissolves all sorts of proteids or albuminous substances; and rennet, a digestive principle which coagulates milk.

It is the function of the gastric juice to digest albumins or proteids of all sorts. This is accomplished by the conversion of albumin into peptone, an exceedingly soluble substance which passes readily through into the blood.

Work Performed by the Bile.

The bile, which enters the small intestine below the stomeach, digests the fats. This is accomplished by the emulsification of the fats and oils of the food. In this work, the bile is aided by the other digestive fluids found in the intestines. Fats are not changed essentially. They are only subdivided into particles so small that they are ready to be taken up by the cells of the mucous membrane, and passed from one cell to the other until they are finally pushed out into the blood current, or the lymphatics.

An emulsion may easily be made experimentally by mixing olive oil with a quantity of gum water. Add to one part of mucilage three or four parts of water Shake until

well mixed, and then add one part of oil. Note that when the oil is first added, the two liquids remain distinct. Shake thoroughly for a minute, when it will become impossible to distinguish the oil from the gum water. The result will be a creamy liquid, which, when added to water, produces a mixture having a milky appearance. If allowed to stand a while, the emulsion will rise to the top as cream rises upon milk.

The Digestive Work Done by the Pancreatic Juice.

This remarkable digestive fluid performs the work of the three digestive fluids which have already been mentioned. In other words, it converts starch into sugar, as does the saliva; it converts albumin into peptone, as does the gastric juice; and emulsifies fats, as does the bile. It thus digests starch, albumin, and fats. The pancreatic juice digests raw as well as cooked starch.

The Action of the Intestinal Juice.

The intestinal juice digests cane sugar, and perhaps acts upon all the other food elements.

The salts are dissolved by the several digestive fluids, some by the saliva and the fluids of the intestine, others which require acids for their solution being dissolved by the gastric juice.

Briefly reviewing the action of the several digestive fluids, let us notice that the saliva digests starch, the gastric juice albumin, and the bile fats. The pancreatic juice digests starch, albumin, and fat. The intestinal juice possibly digests all the food elements, including cane sugar. The first three digestive fluids with which the food comes in contact digest each one food element, whereas the fourth, the pancreatic juice, does the work of the three preceding fluids, and does

it better; for it is able to digest raw starch as well as cooked starch. It digests starch better than does the saliva; it digests albumin better than does the gastric juice, and digests fats better than does the bile.

We note that each of the principal food elements is digested by three distinct digestive fluids. The starch is digested by the saliva, the pancreatic juice, and the intestinal juice, while albumin is digested by the gastric juice, the pancreatic juice, and the intestinal juice. Fats are digested by the bile, the pancreatic juice, and the intestinal juice. Cane sugar is digested in the intestines only, probably by the action of the intestinal juice; and the salts are digested by all the digestive fluids.

Other Uses of the Digestive Fluids.

The digestive fluids perform other important functions besides the transformation and solution of foods. For example, the saliva not only converts starch into maltose, but aids in softening and dissolving the food, thus preparing it for passage into the stomach. Recent observations have shown that the sugar formed by the saliva dissolves the nutritive salts of the foods, thus aiding in supplying the necessary elements to the bones. This explains the fact that rickets in children is so often accompanied by inability to digest starch, shown by bloating of the stomach and bowels.

The gastric juice not only dissolves albumin, but acts as an antiseptic, preserving the stomach contents from putrefaction during the digestive process. The stomach is, in fact, a sort of disinfecting chamber in which germs are destroyed by the gastric juice, thus preventing fermentation and putrefaction and also protecting the body from such diseases as

typhoid fever, cholera, and other maladies due to germs which develop in the alimentary canal.

The pepsin, as well as the acid of the gastric juice, is capable of destroying germs. The stomach mucus also protects the stomach against the action of germs and germ poisons. Both the acid and the pepsin protect the stomach against germ poison and other toxic substances by neutralizing or destroying them. The mucous membrane of the stomach eliminates certain poisons from the blood. It is a most remarkable and interesting fact that the gastric juice, although itself so essential to life, is itself a poison. When introduced into the blood of an animal, it produces insensibility and death.

The bile has a wonderful variety of functions. It is not only a digestive fluid, but it is an excretion, carrying certain poisonous substances out of the body. It prevents the injurious action of the gastric juice upon the mucous membrane of the intestines by neutralizing its acidity. It aids absorption and stimulates intestinal activity.

Evidence of Divine Intelligence in the Digestive Process.

One cannot study the remarkable changes which the food undergoes in the digestive process without being fully persuaded of the existence of a presiding intelligence which guides and controls each step of the process by which the commonest food stuffs, such as bread, fruits, and vegetables, are converted into the living, sentient, acting, thinking, substances of the human form divine. The wisest physiologist, for example, cannot explain on any other grounds than that of a controlling intelligence the fact that the salivary glands form from the alkaline blood an alkaline fluid, while the peptic glands form from the same blood an intensely acid fluid.

Creative Power Manifest in Digestion.

Let us note, also, the fact that the production of the saliva and the gastric juice, and of each of the other digestive fluids in connection with the process of digestion, is a special creative act requiring more than human wisdom, and performed independently of the human will in connection with the digestion of every meal. The secretion of the saliva, for example, is regulated to a nicety, the amount formed each moment being just the quantity necessary to moisten and digest the substance undergoing mastication. If these substances are already moist, the quantity of saliva produced is very small. When liquid foods are taken, little or no saliva is secreted. When very dry substances are chewed, saliva is poured out in abundance. The amount may even equal twice the weight of the substance eaten.

The secretion of the gastric juice is likewise regulated in a most exact manner, both in quantity and quality, to suit the character of the food eaten. Substances containing a large amount of albumin and proteids call forth an abundant flow of gastric juice, whereas starchy and fatty substances do not excite the peptic glands to activity.

The secretion of the liver and pancreas, and also of the intestinal glands, is in the same subtle manner connected with the salivary and gastric secretions in such a way that all co-operate together, both in quantity and quality, in carrying forward the digestive process.

Why the Stomach Does Not Digest Itself.

Another most remarkable circumstance connected with the gastric digestion is the fact that the stomach itself, while able to digest flesh identical with its own substance, is nevertheless in some mysterious manner protected from the corro-

sive action of its own secretion. No physiologist has as yet given a satisfactory explanation of this phenomenon. It must be looked upon as a certain evidence of the constant presence of a beneficent Intelligence.

The transformation of the miscellaneous food substances which enter the stomach, into one common homogeneous red blood, is as great a miracle as the turning of water into wine. That the process is so oft repeated that it becomes familiar renders it not in the least degree less wonderful, and certainly makes no easier the explanation of this remarkable metamorphosis which the most astute philosophers and the most profound scientists have never yet been able to offer.

Digestion does not end with the absorption of the digested foods into the blood current. The final end of the process is in the tissues, and the last act is the transformation whereby substances which have been rendered fluid in the stomach, so that they might be absorbed and circulated, are again rendered solid, so that they may constitute a part of the machinery of the body, and assist in carrying on its work.

Remembering that there are five food elements, five digestive organs, and five digestive fluids, let us now note that there are ten distinct digestive processes, some of which are deserving of a little further study. These are *mouth digestion,* which includes chewing of the food and mixing it with the saliva, or mastication and insalivation, *deglutition,* or swallowing of the food after it has been masticated, *stomach digestion, biliary digestion, pancreatic digestion, intestinal digestion, absorption, liver digestion, circulation,* and *assimilation.*

The Transfiguration of Food.

THE facts which we have already studied clearly show us that man is simply transfigured dust. The miracle-working energy of the sunlight weaves the elements of earth and air into the various substances which serve man as food, and these, by a series of processes, are woven into the infinitely varied fibers and structures which constitute the human body, so that the food we eat to-day, is to-morrow walking about, thinking and speaking. The ear of corn, the handful of grain, insentient and unintelligent, but full of potential energy, has been converted into quivering muscles, warm, vitalizing blood, sensitive nerves, and thinking brain. The ancient Saxons recognized this wonderful fact in the adage, "Every man has lain on his own trencher," which means that every man has seen himself on his plate. Food is vitalized, illuminated dust. Man consists of digested, assimilated, transfigured food. The whole process, from dust to brain and human thought, is a series of successive transformations in which the presence of the divine hand is everywhere discernible, lifting, illuminating, transfiguring. The power which weaves the mysterious fabric of life in the formation of living flesh from food is not a mere mechanical, physical agent, a vibration, an undulation in the great ether ocean; it is the same creative energy which made the worlds, and holds them steady in their circling paths.

"God is light," says John the apostle; so if in the glorious rays of the sun we recognize the presence of God, we must see the same in the fruits, the grains, the nuts, the bread,—all foods. When the divine teacher said, "I am the living

bread which came down from heaven (John 6:51), his declaration was not merely a mystical figure of speech, but the expression of a fact, a reality, a scientific truth. And when he said, "The bread which I will give is my flesh, for the life of the world" (John 6:51, New Version), he called our attention to the fact that God himself enters into our bodies in the taking of food; that he is the very substance of food,—the living bread from which all bodily energy is derived, which supports and maintains every function of life, and which is the vehicle by means of which our ever-wasting and decaying bodies are continually replenished and renewed, or re-created.

The apostle Paul recognized the same great truth: "In whom we live, and move, and have our being." Acts 17:28. We thus owe all to God. We not only owe to him the beginning of our life, but we constantly derive from him our nourishment, our support. We feed upon him, absorbing in our food the very substance of his body, a thought which renders sacred and glorious everything connected with the act of eating, and forbids the use of the palate merely as a source of pleasure.

The Miracle of the Corn Field.

We read with wonder, perhaps sometimes with questioning faith, of the restoration of life to the widow's son, of the resurrection of Lazarus, of the feeding of five thousand with a few loaves. May not our feeble faith be strengthened as we stand face to face with the miracle of a great corn field — a thousand acres, perhaps, of tall stalks bending low with their golden burden of grain — fifty thousand bushels — and every kernel a miracle; every bushel capable, through the trans-

figuration of nutrition, of being converted into a king or a queen, a philosopher or an ordinary human plodder! Think of it! fifty thousand men springing right up out of the earth in one little corn field! Certainly the day of miracles is not past.

Let us now study briefly the different steps by which food is transformed into living, thinking, human being — a veritable transfiguration, the insentient made sentient, the shapeless made symmetrical and beautiful, the dumb to speak.

Mouth Digestion.

The process of mouth digestion consists in the mastication, or chewing, of food, the secretion of saliva, and mingling of the same with the food, and the conversion of cooked starch into sugar (maltose). By mastication, the food is reduced to fine particles; the process is aided by admixture of saliva. The amount of saliva formed depends upon the character of the food. Dry and highly flavored foods cause the salivary glands to pour out an abundance of saliva, whereas liquid foods excite the activity of the salivary glands very slightly or not at all. To insure an abundant outflow of saliva, it is, then, highly important that food containing starch shall be eaten dry, and that it shall be thoroughly chewed, being retained in the mouth for a sufficient length of time to secure the secretion and the admixture of a sufficient amount of saliva to do the work required of this important digestive fluid. If the mastication continues long enough, some portion of the starch is converted into sugar while it is still in the mouth. It is this which gives the sweet flavor to a bit of crust or a hard cracker which has been chewed for a long time.

Thorough Chewing a Matter of Greatest Consequence.

Prolonged mastication is also of the highest importance for other reasons. Mouth digestion is the first of a series of changes which take place in different parts of the alimentary canal, and which together constitute the digestive process. If the first of the series of change is performed in an imperfect manner, all the succeeding changes are likewise more or less defective; that is, stomach digestion cannot be well performed unless mouth digestion has been well done. Taking the food into the mouth is a signal to all the digestive organs to prepare for work. Even the sight and the odor of food may cause an outflow of saliva, and at the same time the gastric juice begins to pour out into the stomach.

Pawlow's Interesting Experiment.

Pawlow, of St. Petersburg, in experiments upon a dog, observed that when food was introduced into the animal's stomach through an opening made for the purpose, no digestive activity followed; the gastric juice was not poured out, and the stomach apparently remained inert. On the other hand, when the animal was allowed to see and smell of the food, the saliva and the gastric juice poured forth abundantly, even though the animal did not actually taste a morsel. It is important that the food should be retained in the mouth for a sufficient length of time to make the proper impression upon the nerves of taste, so that the entire digestive apparatus shall be thoroughly prepared to carry the food substances through the successive steps of the digestive process. Food should remain in the mouth until reduced to a soft, pasty consistency that will mix readily with the gastric juice and other digestive fluids.

The stomach is not capable of grinding and reducing the food. If this work is not done in the mouth by the teeth, that portion of the food which enters the stomach in the form of coarse particles will remain there a much longer time than is necessary. The digestion of food which has been properly prepared in the mouth by thorough chewing, is of great importance, and should be mentioned here. The gastric juice does not remain in the stomach for an indefinite time. Absorption begins after the food has remained in the stomach three or four hours, or long enough for digestion to take place under favorable conditions. It is thus very clear that if the food is imperfectly chewed, some portion of it may be left in the stomach after the gastric juice has been partially or wholly absorbed; there is, consequently, no protection against germs which enter the stomach through the mouth. Fermentations and putrefactions readily take place. The undigested food stuffs furnish abundant material for the germs to feed upon, so that they multiply with great rapidity. If there are present in the food considerable quantities of sugar and partially digested starch, there will be a rapid growth of germs which feed upon these substances, and the result will be the formation of gases and acids in large amount. Sour stomach, heartburn, and colic are some of the maladies thus produced. If there is present in the undigested foods a considerable amount of albumin or proteids, as when meats are eaten, the growth of those germs which feed upon these substances will be encouraged. These germs are of a sort very dangerous and destructive. They do not give rise to fermentation, but cause putrefaction, the result of which is catarrh of the stomach, biliousness, jaundice, and various inflammations of the stomach and bowels. This condition encourages the development of typhoid fever, cholera, and other infectious

diseases of the stomach and bowels. The stomach is exhausted by the long-continued efforts required to empty itself of its foul contents. Its muscular walls are weakened by inflammation. The consequence is dilatation. It may be in time stretched to twice its proper size through distention by gases. Dilatation of the stomach prepares the way for many diseases, by encouraging the growth of germs.

The importance of mouth digestion, and of the action of the saliva upon the food, has not been fully appreciated until recently since it has been made clear that the action of the saliva upon the starch, which begins in the mouth, continues for thirty or forty minutes after the food has entered the stomach. It should be noted that the saliva acts only upon the starch, and that it has no influence whatever upon sugar, fats, or albumin.

The Remarkable Discoveries of Horace Fletcher.

Mr. Horace Fletcher, a wealthy gentleman residing in Venice, Italy, has recently called the attention of the scientific world to the results of experiments conducted by himself and the physicians associated with him, which show that the prolonged mastication of food increases greatly its nutritive power, so that the amount of food eaten may be very considerably reduced without diminishing the bodily strength or weight. These experiments have been repeated in the laboratories of the great university at Cambridge, England, under the supervision of Prof. Michael Foster, the eminent English physiologist, and the results obtained by Mr. Fletcher have been verified.

Mr. Fletcher finds that when the food is chewed carefully and thoroughly, it is, by a reflex action, moved forward by the muscles at the back of the throat at frequent intervals

during mastication, thus retaining it in the mouth until every particle has been reduced to a fluid or semifluid state. In those who have been accustomed to eat rapidly, especially those who eat very little dry food, and who drink in connection with their meals, this reflex is not active, but it is recovered in the course of a few weeks when a persistent effort is made to chew the food thoroughly, and becomes a sort of physiological mentor guarding the entrance to the stomach in the same way that the pylorus guards the way to the small intestine. Persons who have difficulty in swallowing a pill will understand what this reflex is, although its ordinary action is much less violent, and hence may be overlooked until attention is called to it.

Those who desire to eat physiologically, and thus maintain the body temple in its best condition, should, as far as possible, take the food in a dry state, and should cultivate the habit of chewing the food until all the soluble parts have been thoroughly dissolved and reduced to a liquid state. As a rule, this will be until a sufficient amount of saliva has been secreted to wash out of the food all substances having taste; that is, each morsel of food should be chewed as long as there is any taste left in it. Strongly flavored substances which are wholly soluble should be held in the mouth until so diluted by the saliva that their flavor has nearly disappeared. Any one who will take the trouble to adopt and carefully follow these suggestions will be more than amply rewarded by the increase in strength and energy, the greater enjoyment in eating, and the disappearance of gastric disturbances of various sorts; in fact, nearly all forms of gastric disease, except a few incurable maladies, may be quite readily cured by the following of this simple suggestion alone, providing, of course, that the

foods eaten are of proper quality, and taken in the proper quantity, and at suitable intervals.

The activity of the saliva in the stomach continues only until the gastric juice has been secreted in sufficient quantity to render the stomach contents acid. The action of the saliva is interfered with by various acids as well as that of the gastric juice. For example, vinegar, even in a small amount, destroys its action entirely. A single teaspoonful of vinegar taken at a meal is sufficient to entirely destroy the action of the saliva upon the starch, even though the proper amount may be secreted. The tannic acid found in tea and coffee has precisely the same effect. Some strong vegetable acids — as, for example, oxalic acid, which is found in pieplant — destroy the action of the saliva when present in so small a proportion as one part to six thousand. Citric acid, the acid of lemons, sour oranges, limes, and some other fruits, when present in large amount, also prevent the proper action of the saliva: Malic acid, found in sour apples, tartaric acid, and the acid of grapes have the same effect if present in considerable quantity, especially in hyperpepsia, in which an excess of hydrochloric acid is secreted, cases of which are by no means uncommon.

Fats interfere with the action of the saliva, when mingled with starch in the form of oils or unemulsified fats. Fats, in a state of nature, are found in an emulsified condition, that is, divided into minute droplets. Emulsified fat does not interfere with the action of saliva upon starch, for the reason that the fats and the starch remain separated; but oils, melted butter, and other fats, when brought in contact with the starch, permeate the starchy particles, and render them impervious to the saliva, thus interfering with the digestive change by which starch is converted into sugar.

Stomach Digestion.

The digestive work especially characteristic of the stomach is the digestion of albumins through the action of the gastric juice. This should begin about thirty or forty minutes after taking food into the stomach, or as soon as the gastric juice has been secreted in proper quantity, and at about the moment when the salivary digestion of starch ends. The secretion of the gastric juice is called forth by certain elements of the food not previously mentioned, which are known as *peptogens.*

Peptogens.

There are various peptogenic substances found in foods, some of which give rise to the formation of pepsin, while others stimulate the secretion of hydrochloric acid. These peptogens either exist already formed in the food, and are dissolved by the saliva, or are produced by it in its action upon the food. The digestive activity of the stomach has been found to be increased as much as twenty-five times by the addition of these peptogens, which constitute a sort of stomach food, or natural stimulus to the stomach, by which its energy is called forth. A peptogen is probably more than a stimulant. It not only excites the stomach, but provides it with the material necessary to enable it to prepare the marvelously active substances by which the albumins of the food are dissolved and converted into peptone, and thus prepared for absorption. Pure albumin taken into the stomach is found to provoke little or no digestive activity. By the addition of the peptogens which are largely found in fruits and properly prepared cereals, an abundance of active gastric juice is formed.

The existence of peptogens in the food, and especially their production by the action of the saliva upon the food

elements, is one of the most interesting of all the numerous remarkable facts connected with the process of digestion, and shows us how the different digestive processes are linked together in such a way that the perfect performance of each one depends upon the thorough completion of the preceding ones.

The action of the gastric juice is facilitated by muscular movements, which are chiefly due to the contraction of the stomach walls and to the action of the diaphragm. These various movements combined constitute a sort of churning process, by which the food substances in the stomach are thoroughly manipulated and mingled, and, so far as possible, reduced to a fluid state. At the end of three hours, the acidity of the stomach contents is at its maximum, also the muscular activity of its walls. The contraction finally becomes so vigorous that the fluid portions of the food are forced through the pylorus, which is always well contracted, into the intestines, where the bile and the pancreatic juice begin their work.

Biliary Digestion.

As the food enters the intestines, the bile acts upon it, saponifies some of the fat, and aids the pancreatic juice in the complete digestion of the food elements.

Intestinal Digestion.

The food is moved along in the intestines by the action of their muscular walls, which contract at regular intervals. In the intestine, a special class of digestive ferments, known as enzymes, act upon the several sugars,— cane sugar, milk sugar, and maltose. The ferment which digests maltose, the sugar formed by the digestive action of the saliva upon starch,

is most abundant in adults. The ferment which digests milk sugar is abundant in infants, but is present only in a limited quantity in adults. The ferment which digests cane sugar is least abundant of all, and is often found almost wholly lacking, a fact which indicates that cane sugar is not as well adapted to the human system as is maltose. This might be fairly inferred from the fact that cane sugar is chiefly found in the coarser vegetable products, such as roots, stems of coarse, grass-like plants, and in the sap of trees. Maltose is a natural product of digestion; fruit sugar is found in a great variety of fruits, and is a constant and important element in man's bill of fare.

The pancreatic juice and the intestinal juices complete the digestion of all the food stuffs, which are thus prepared for absorption and for succeeding changes. At the end of three hours the food begins to disappear from the stomach. Acidity of the contents readily diminishes.

Absorption.

The stomach is a preparatory chamber in which the food is reduced to a fluid state. The small intestine moves the food along to the colon, a distance of some twenty-five feet. During its transit through the small intestine, a certain portion of the digested food elements is absorbed; the remainder is deposited in the large intestine, the principal function of which seems to be to present an absorbing surface to take up the digested food.

Liver Digestion.

In the liver the food is acted upon by the cells of this important organ in a very remarkable way. The albumins which have been digested in the stomach and intestines, are,

as one might say, inspected by the liver, which puts on certain finishing touches, rejecting any unusual or poisonous materials which may have crept in. The starch which has been converted into sugar, is, by the liver, reconverted into animal starch or glycogen, in which form it is stored up in the tissues of the liver until needed for body-work or heat production, when it is doled out as needed. The digestive function of the liver is not the least of its many most interesting and important activities, some of which will be considered further on. There is no more marvelous manifestation of organic intelligence in the body than that shown by this great brown gland in the regulating of the supply of sugar to the blood in the interim between meals. In this respect the liver might be looked upon as a sort of living, automatic "stoker," which supplies fuel to the body as needed, as devices made for the purpose supply coal to the furnaces of steam boilers.

Here we have another proof, not only of the marvelous benevolence and wisdom of man's Creator, but of his constant presence and unfailing vigilance in guarding the interests of the body, and providing for its needs. If all the sugar formed from the digestion of starch, which constitutes more than half of the bulk and weight of our natural dietary, or about one pound a day, were thrown at once into the blood and general circulation when absorbed from the stomach, the heat-making processes of the body would be excessively excited; or, if the sugar was not oxidized, or burned, the kidneys would be at once called into activity to eliminate the sugar, and it would thus be lost to the body. This condition is sometimes present, as in a disease known as diabetes, in which varying quantities of sugar are discharged through the kidneys.

The liver does not deal with all sorts of sugars with equal

facility. Just as some fuels are more easily handled than others, so some sugars are more easily stored and distributed by the liver. Of all the sugars, cane sugar and milk sugar are least readily dealt with by the liver. Maltose, the sugar formed from starch in digestion, and levulose, the sugar of fruits, are most readily utilized.

Circulation of the Digested Food.

After the food has passed through the liver, it is carried to the heart, from which it is distributed through the whole body, carrying to each part potential energy and material for rebuilding the wasting tissues.

Assimilation.

The final act of nutrition is the conversion of the liquid blood into solid tissues, a change exactly the reverse of that which occurs in the stomach. Here the transfiguration is completed. Each tissue takes from the blood the material needed for its own repair, and builds the nutritive elements into a fabric like itself. Assimilation is nothing more nor less than creation. It is the formation of living substances, the building of tissues and organs, living machines, out of the blood, the stream of life which serves as a sort of circulating market, or, one might say, a canal, along which the nutritive elements prepared in the stomach or other digestive organs, are conveyed to the places where they are needed.

There are found in the tissues remarkable substances which play the part of regulators of the assimilative process. These enzymes are produced in the liver, the pancreas, and certain other of the large internal glands. It is under the influence of these enzymes, which are allied to pepsin and other digestive ferments, that the liquid blood is converted

into solid tissue, and that the energy locked up in the food is set free through the action of oxygen with the elements of the food. There are a half dozen or more of these enzymes in the blood, each charged with a certain duty. There are others in the muscles, others in the nerve centers. The wonderful action of these enzymes can be explained in no other way than by the recognition that they are divine agencies acting under the control of that marvelous Intelligence which guides and rules all the activities of the universe, and which is so wonderfully manifest in all the life processes of animate nature.

Dietetic Sins.

SAID the prophet, "Eat ye that which is good." Isa. 55:2. Said the wise man, "Thou puttest a knife to thy throat, if thou be a man given to appetite." Prov. 23:2, R. V. Let us ask the practical question, "What is good to eat?" On one occasion, after the author had given a lecture on dietetics, a gentleman in the audience, with a good deal of complacency, asked the question, "If we cannot eat the pig, what shall we do with him?" evidently feeling that he had presented an unanswerable argument, since he could find no other possible use for the scavenger than to serve as food. It was only necessary to ask in reply, "Must we eat everything which we do not know what else to do with?" The idea that we must eat things to get them out of the way is too monstrous for consideration, and it will not do to suppose every animal or plant, the practical utility of which is not at once apparent, may be eaten. Degenerate man has but a faint glimpse of animate nature, and can know but very little indeed of the divine purposes, which, though clearly written on the pages of that divine book commonly termed Nature, are divulged to those only who seek long and patiently.

The Divine Way in Diet.

Evidently the things "good to eat" must be those which the Creator designed for man's sustenance. To deviate from the divine order in eating is, as the wise man suggested, nothing more nor less than suicide, which is true of every

other distinct deviation from the path marked out for us by Him whose offspring we are, and who invites us to feast upon his own body presented to us in fruits and other of the higher products of the earth. The divine order of life is revealed in Gen. 1:29, which presents, as man's bill of fare, a dietary of fruits, nuts, and seeds. That this was the original and natural diet of man is a demonstrable scientific fact. According to the most eminent naturalists, this bill of fare is clearly indicated by man's very structure; his hands, his teeth, his stomach and intestines, his entire body, indicate that his food should be drawn from the higher products of the earth, the fruits and nuts and herbs.

"Whether therefore ye eat, or drink, or whatsoever ye do, do all to the glory of God." 1 Cor. 10:31. It is manifest that the only way in which one can really eat to the glory of God is in eating the things which God himself created to be eaten, which he presented to man in the beginning as substances especially designed for his sustenance. Eating must not be regarded as a pastime, as a means of pleasurable diversion or entertainment. For many generations the palate has been made a source of pleasure, and to the great detriment of the race. A large share of the physical degeneracy that is increasing on every hand may be traced directly to improper eating, to the eating of things never designed to be eaten, and which no one would ever think of eating, except for that fact that they momentarily give an agreeable sensation to the tongue and palate. No thought or consideration is given to the possible effect of these palate-tickling substances upon the stomach after they have entered it. A gentleman once said to the author, "I eat mustard, pepper, pepper-sauce, and similar hot substances for the reason that I like things which give my palate a twist." This gentleman,

with millions of others like him, quite overlooked the fact that those things which "twist the palate" are equally able to "twist" the stomach, the liver, the nerves, the brain, and every organ and tissue with which they come in contact during their journey though the body. These palate-twisting or tickling substances have no food value, but are capable of producing a vast deal of mischief in the vital economy; they lay waste the living temple by introducing elements which are in the highest degree obstructive and destructive.

Pure Food the Light of the Body.

Said the Christ, "If thy whole body therefore be full of light, having no part dark, the whole shall be full of light, as when the bright shining of a candle doth give thee light." Luke 11:36. As we have elsewhere seen, pure food is light, —light stored, done up in bundles convenient to enter into the service of the temple,—the vehicle by means of which God's own life and energy become a part of the living body. Food is the fountain which supplies the ever-wasting stream of life.

Is it not apparent, then, that the filling of the body with light, illuminating it, so to speak, is to be accomplished by eating pure food; and that, if we would have "no part dark," we must be careful to introduce into it nothing by which darkness will be communicated to it. Light is life; darkness is death. A body full of light is a body full of life, activity, and energy; a dark body is dead or dying. It is evident that the words of the Christ have a profound spiritual meaning; but it is equally evident that, like other great fundamental truths, their application is as exact and apt in relation to physical, as in relation to spiritual things. Indeed, when we come to look at nature and man and their relations to God

in their true light, those barriers and distinctions by which men are accustomed to separate spiritual and moral things from natural things disappear from view, the wall of partition between the natural and the spiritual is broken down, and all things become changed; not that the spiritual is brought down, but that the natural and the physical are lifted up, spiritualized, transfigured. And it is the purpose of this book so to lift up the divine temple in which God declares he himself dwells, that it will no longer appear, in any of its functions or features, to be gross, material, or earthly, but that it may appear that glorious and masterful work of God which it is created to be, by the divine light which shines within and through it.

Living Tissues Transparent.

Let us note, then, the exact truth of the Master's words. Here, for example, is a living earthworm. Hold it up to the sun, and observe the bright red glow of the light through its translucent tissues. Now find, if possible, a dead worm; hold this up beside the living one, and note that it is opaque,— the light does not readily shine through it. Here is another illustrative experiment. Wind a string or a rubber band about a finger in such a way as to obstruct the circulation. Presently the finger will lose its rosy color, and acquire a bluish appearance. Now hold the hand up before an electric light or a bright lamp, as close to the light as possible without burning, and a marked contrast will be noticed between the constricted finger and the others; it is evidently more opaque. If the constriction has been applied for some time, the finger will be almost entirely opaque or black, while the other fingers will present a bright red glow under the influence of the light which penetrates the tissues. Living tissues are transparent; dead tissues are opaque; and this is the lesson which we learn,

In the case of the constricted finger, the tissues are not actually dead, but dying, as the result of an accumulation of tissue poisons. If the constriction should be continued for any considerable length of time, it would thereby prevent the escape of poisons through the washing action of the blood, and actual and permanent death would occur. Light is life and health,— darkness is disease and death. Whatever introduces darkness into the body must bring with it disease and death sooner or later.

God Feeds the World.

The divine Master taught us to pray, "Give us this day our daily bread." This prayer reminds us that God is the great Father who feeds the world. The patriarch Jacob knew this, for he said, "He hath fed me all the days of my life." Gen. 48:15. In Prov. 30:8, we read that Agur in his prayer said, "Feed me with food convenient for me." Convenient food would be that which is adapted to one's nature, constitution, and immediate needs. No food could possibly be more convenient than that which was created for Adam, the first man. The marginal rendering of the text is, "Feed me with the bread of my portion." In Gen. 1:29, man is definitely told what portion of the world's supply belongs to him, namely, fruits, nuts, and grains. In Ps. 147:9, we read, "He giveth to the beast his food, and to the young ravens which cry." Each particular class of animals has its own bill of fare, prepared for it by its Maker. Man, beast, birds, fishes, even the insects,— all the living creatures of the earth,— are guests at God's table. Each is provided with the food which is adapted to its needs. How unnatural and unseemly that guests at Heaven's banquet, all alike sharing in the All-Father's bounty, should turn and rend and

devour those who, like themselves, have been invited to "eat that which is good." Convenient food is certainly not such food as will produce disease and infirmity, shorten life, blunt the sensibilities, cripple the faculties, debase the morals, or otherwise lessen the beauty and dignity of the image of God, or mar and deface the living temple. Neither can food be called convenient which is only obtainable at the expense of such an enormous amount of suffering and such a prodigious sacrifice of life as is involved in the preparation of animals for use as food.

We are now prepared to consider, more in detail, the particular evils which arise from numerous common errors in diet, in the use of improper food, and in departures from the divine way.

Careless Temple Building.

The carelessness displayed in the manner in which civilized human beings build their living temples is equaled only by the rude and uncouth fashion in which the ignorant savages of the forest build the temporary huts in which they dwell. The natives inhabiting the hot lands along the gulf coast of southern Mexico construct their homes of grass, which, rendered crisp and inflammable as tinder by the hot torrid sun, may be ignited by a spark, and in a few moments disappear in smoke. On the rocky slopes of the great Mexican desert, where vegetation is confined to a few shrubs and thorny cacti, one may see hundreds of human beings living in habitations which, at a little distance, look to be mere heaps of brush and rubbish jumbled together in the most miscellaneous manner, affording only partial shelter from the sun, and not the least protection from rain (which fortunately seldom comes), and which a little puff of wind may at any time

scatter broadcast over the sandy plain. A somewhat more fortunate savage builds a hut of mud, which excludes the sun and rain, but is readily dissolved, and carried off by a flood. The Arab dwells in a temporary abode of skins, which forms a shade and shelter from the rain, but does not afford much protection from the wind and dust storms that often sweep down over the great desert on the borders of which he lives.

The more wealthy and enlightened civilized man builds his house of stone or brick, or timbers securely fastened together. Instead of huddling together such materials as he finds most ready to his hand, he brings solid beams from the forest, granite blocks from the mountains, iron from the mines, and if he has an abundance of means, he spares no pains or expense to bring together the choicest and most enduring materials from which to construct the house in which he dwells.

So the hut of grass or boughs or mud or animal skins which the savage builds becomes transformed into the mansion, the palace, the castle of the civilized man, a fit representation of his growth in knowledge, in resources, in self-respect, in appreciation of the privileges, blessings, and opportunities of an elightened life.

How strange it is that while civilized man has thus improved the character of his dwelling, his temporary home, he should have made apparently almost no progress at all — has even retrograded — in relation to the building of his living temple. As the savage builds his hut of those materials which he finds close at hand, or most accessible with little reference to their durability or stableness, so he builds his body of those foods which are most easily procurable, or

which he finds most convenient to his taste, for which his appetite clamors, and which produce the most agreeable sensations while slipping by his palate, or momentarily detained in contact with his tongue. One tenth of the time given to the study of dietetics which is given to the study of house building, selection of materials with reference to strength, durability, and adaptation to desired ends by most civilized men and women, would lead to a thorough revolution in prevailing customs and habits in relation to diet.

The man who would decline to have built into the front wall of his beautiful brick mansion imperfectly burnt brick which he knows will soon crumble and mar the beauty and strength of the structure, or would on similar grounds reject as building material chips or blocks of wood, bits of coal, cinders, broken crockery, leaves, tin cans, old bottles, and similar rubbish, would, in giving thought to the selection of materials for the building of his body temple, exclude from his dietary such indigestible and hence unusable rubbish as pickles, green olives, brandied peaches, condiments of all sorts which are indigestible as well as irritating, and a long list of dishes spoiled by unwholesome mixtures of various sorts, and labeled with foreign names to hide their ingredients. What would be thought of a man, who, in building the house in which he intended to shelter himself and his family, putting into it the carefully hoarded earnings of many years, should, in constructing the walls, put in here and there a mass of tinder or straw or other easily combustible material; now and then mixing in a few pounds of gunpowder or nitroglycerin, with a handful of percussion caps near by, with bottles or cans of gasoline, naphtha, benzine, cotton, or other light material saturated with these inflammable liquids, mixed

with boxes of matches, sulphur, phosphorus, and other chemical substances which take fire at a touch or often spontaneously burst into flame? Certainly such a man would be looked upon as a lunatic or an imbecile. The court would appoint a guardian to take charge of him to prevent his idle waste of money and the construction of the death trap conjured by his unbalanced brain. Really the figure is not in the least overdrawn. Peruse the items on any ordinary hotel bill of fare, review the menu of your last Christmas or Thanksgiving feast, even the last meal you ate, and consider how much of the material provided was worthy of being built into the temple of the living God.

When Solomon constructed the temple upon Mount Moriah, no wood was good enough to form the rafters to support the roof which covered the ark, or posts to sustain the gorgeous draperies which hid the Shekinah from the eyes of the multitude, but cedar from the heights of Lebanon. In and about Jerusalem one may still find woven into buildings parts of the beautiful pillars wonderfully wrought by Solomon's sculptors from marble, painfully transported from quarries hundreds of miles away. That wonderful temple, the marvel of all the ages, the like of which the earth has never seen, was only a figure, an object lesson pointing to the real temple, the "tabernacle not made with hands." In the construction of the body temple, God is the builder, but the responsibility of furnishing the material rests upon man.

Have you ever thought of the matter in this light, dear reader? Have you ever considered, when sitting down to eat, and asking the divine blessing upon the meal prepared, the question, "Can the divine forces at work within me, the Spirit of God which constitutes my life, weave out of the

materials here spread out, a fine, beautiful, enduring fabric of brain and muscle and nerve and bone, capable of high thinking, fine feeling, strong and noble acting, a consistent conduct, and a faithful witnessing for God as a worthy specimen of his handiwork? If you have not, let me ask you earnestly if these are not the questions which should interest you as a rational being, enlightened as to your royal origin as a son or daughter of God, and your high mission as a representative and ambassador of God, a witness before the world and the universe, and your possible destiny as a citizen of a renovated earth, with an infinite life unfolding before you?

In the presence of these great facts and possibilities, is it not the duty of every human being to take care that he shall eat to the glory of God, and not to the pollution and destruction of His temple? Is it not true of one who pursues an opposite course that he "eateth and drinketh damnation to himself"? The consequence of such eating and drinking we see all about us in the vast army of dyspeptics, rheumatics, consumptives, and wretched subjects of nervousness, nervous exhaustion, paralysis, and even insanity.

Eating for Disease.

A large share of all human ills may be properly traced to "unworthy eating." Here is a poor dyspeptic, for example. Ask him how he became ill. He readily confesses it was by wrong eating. He says, "I thought I could digest anything, and so I ate everything, as much as I wanted, and as often as I could; but now I can eat nothing at all without distress. I can digest nothing." The sunken eyes, the bent, wasted frame, the pale cheeks, the feeble pulse, the tottering steps, indicate that the body temple is in ruins, that its walls are tumbling down, that the golden bowl is broken, and that the

Shekinah, that light "which lighteth every man that cometh into the world," is departing from the habitation that once was a thing of beauty and of strength, full of life and joy and energy, now destroyed, not through neglect by the divine Builder, but by the hand that was made to care for and to keep it, to co-operate with the divine Architect and Builder in replenishing its stores of energy, in embellishing and beautifying its walls, and maintaining continually in all its departments a sweet incense of loyal, faithful service.

Let us notice now some of the particular ways in which men and women habitually err in supplying material for temple building,— in other words, in eating and drinking,— together with the reasons thereof; reference to the principles already considered will easily make this clear. Let us also seek to find out in each instance the right way that should be substituted for the wrong one, so that our knowledge may be positive as well as negative, and that we may know not only what *not* to eat and how *not* to eat, but *what* to eat and *how* to eat it.

The Selection of Food.

Practical diet reform must begin before sitting down to the table to eat. It must begin in the kitchen; indeed, we must even go beyond the kitchen. Even the wisest, most skillful and conscientious cook cannot prepare good food from poor materials. The family steward, the one who provides the food supplies, is primarily responsible, and hence must be made intelligent in relation to the bodily needs.

It seems almost needless to remark that food must be sound, mature, in good condition, free from disease, sufficient in quantity, of fine quality, and of such sort as will furnish the body with the elements which it requires for com-

plete nutrition. There must be sufficient variety to meet the needs of all the members of the family, and prevent loss of appetite from too great monotony in the bill of fare. Even horses and cattle require an occasional change of food.

The food supply should first of all include a variety of grains, preferably whole-grain preparations, of wheat, corn, oats, and rice. Rye and barley may sometimes be advantageously added, and even buckwheat; but these grains are inferior in nutritive value to those mentioned, and can hardly be considered as essential. The grains furnish chiefly starch, with a fair but hardly sufficient allowance of albumins.

To secure a sufficient supply of albumins and an adequate allowance of fats, a liberal supply of nuts must be provided. Of our domestic nuts, the most valuable are the pecan, which grows abundantly in the South; its near relative, the hickory nut, which grows in most parts of the North; almonds, which flourish in California; and the peanut, a legume, a native of the South. Walnuts, butternuts, hazelnuts, and beechnuts are also valuable nuts, though less abundant and not so generally accessible as the varieties mentioned. The chestnut is also a valuable food, but its composition is more nearly allied to that of the grains.

Next must be mentioned a supply of fruit, both fresh and dried, and if possible, canned fruits. This great country affords such a marvelous variety of climates, our markets present at different seasons of the year almost every wholesome and valuable fruit known to the whole earth. Peaches, plums, cherries, strawberries, raspberries, blueberries, whortleberries, nectarines, apricots, and grapes in great variety are found abundantly in nearly all parts of the United States, each in its season, and should constitute at those times a liberal feature of the daily bill of fare. Every family should

provide, when possible, a supply of these fresh fruits, properly canned in glass, using as little sugar as possible, and of course avoiding the use of chemical preservatives of any sort. Apples and certain varieties of pears may be procured almost the entire year round, and are of value as sources of wholesome fruit acids. Melons are also valuable and wholesome in the hot months. Dried fruits may be had at all seasons of the year, and are entirely wholesome when properly prepared, to a large extent taking the place of fresh or canned fruit.

Another important class of food stuffs, which should be supplied in abundance and variety, is the legumes, or seeds produced by pod-bearing plants. In this class are included the various varieties of beans, peas, and lentils. These furnish an abundance of albumin, a considerable portion of starch, but very little fat.

Lastly we may mention vegetables as a part of the necessary or at least valuable food supply, though it must be confessed that this class of foods is far less important than those previously mentioned. The common Irish potato and the sweet potato are certainly valuable foods, and a certain food value attaches to beets, parsnips, asparagus, cauliflower, and even cabbage; but the last-named vegetables are little more than crudely flavored leaves and stems, possessing so little nutritive value that it is hardly worth one's while to eat them, except now and then, perhaps, as a means of securing variety or necessary bulk, when this is desirable without an increase of nutritive material.

In order that we may become thoroughly intelligent in relation to these various valuable food stuffs and their uses, in the next chapter we will give some further attention to the consideration of the several important classes of foods, cereals and legumes, nuts, fruits, and vegetables.

CEREAL FOODS AND LEGUMES.

Bread.

From the earliest ages bread has constituted the "staff of life" for the most enlightened members of the human family. Wherever agriculture has been known, the mill in some form or another and breadmaking have likewise been known. In the Orient, one may still see in use the ancient hand mills which have been employed in that country from time immemorial, and the noise of the grinding is still heard in the villages of Syria as in days of old. The accompanying cut is made from a photograph of a very ancient Oriental mill brought by the author from Egypt a few years ago. In other cuts are given views of the primitive mills used by the people of different nations.

Primitive bread consisted of meal made from grain previously washed, dried, and ground, mixed with a little water, formed into a thin cake, and baked on a flat stone or tin over an open fire. The Arab women and the Indian women of Mexico and the southern part of the United States still bake their bread in precisely the same manner. The negroes of the South have ingeniously modified the bread-making process in the making of their hoe-cakes, an exceedingly wholesome bread which consists of corn meal mixed with water and a little salt, and baked upon a board before an open fire.

The bread-making cereals are wheat, corn, rye, barley, and oats. A word concerning each may be of practical interest.

Wheat.

Wheat is the best of all the bread-making grains, as well as one of the most nourishing, because of the large amount of gluten which it contains. *Gluten* is an albuminous substance made up of a number of different kinds of albumin,

1. Oriental Mill.

2. Indian Mill.

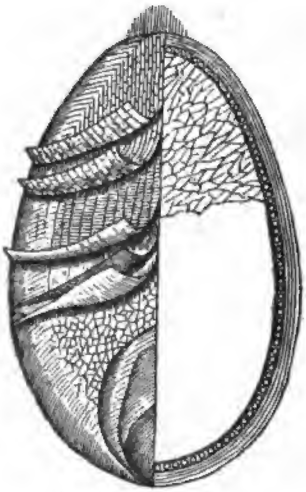
3. Syrian Mill.

4. Mexican Mill.

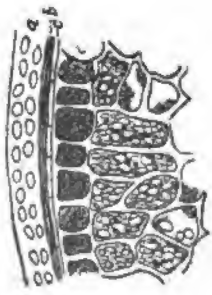
ANCIENT METHODS OF GRINDING MEAL.

A GRAIN OF WHEAT, MAGNIFIED

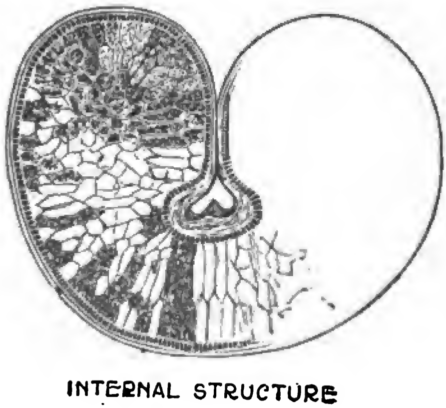
WHEAT WITH OUTER COAT REMOVED.



THE DIFFERENT LAYERS OF BRAN.



GREATLY MAGNIFIED VIEW OF A SMALL PORTION OF A GRAIN OF WHEAT



INTERNAL STRUCTURE

including *vegetable gelatin,* which combines the various albumins together, forming a substance which, when in the pure state and moist, has a peculiar rubber-like constituency. It is the tenacity of this gluten, by which bubbles of air or gas are confined, which renders wheat flour superior to that of other grains for the making of light bread.

Gluten is one of the most highly valuable elements of the grain. It serves especially to build up brain, bones, nerves, and muscles as well as blood. It is found in the greatest abundance in the outer layers of the grain, the balance of the kernel consisting chiefly of starch. The accompanying cut gives something of an idea of the structure of the wheat kernel, and shows clearly how modern processes of milling may lead to the loss of one of the most important elements in the grain. Cheap grades of "family flour" contain very little gluten, consisting chiefly of starch. The higher grades of patent flour are generally quite rich in gluten, but the best flour is that made from the whole grain. The so-called whole-wheat flours are not usually made from the whole wheat, as the name suggests, but consist of combinations of various sorts, and do not include the coarser portions of the bran.

The best of bread-making meal is well-ground graham flour. It requires more skill to make fermented bread from graham flour than from fine white flour or whole-wheat flour; but rolls, crackers, and very excellent wafers may be easily made from graham flour. Water breads, or so-called unfermented breads, made without yeast or baking powder, are superior to all other breadstuffs. When properly baked, that is, until slightly browned, they constitute the best of all breads, and represent by far the most perfect method of preparing cereals for use as food. The salts contained in graham flour

are necessary to properly nourish the bones and the teeth. The deficiency of these elements in the breadstuffs commonly employed may be in large measure responsible for the premature decay of the teeth that is coming to be almost universal among civilized human beings, especially in the United States.

Different varieties of wheat differ greatly in the proportion of nutritive elements which they contain. For example, as a rule, white wheat contains a much larger proportion of starch and less gluten than red wheat; spring wheat is much richer in gluten than winter wheat, but has more bran. Good wheat ought to contain one seventh of its weight of dried gluten. In some special varieties of wheat the proportion is considerably greater than this, while in the poorer varieties the proportion may be scarcely more than one half that mentioned.

Flour must be good in quality. Not infrequently flour is made from musty wheat, or from wheat infected with germs, which differ greatly in quantity and variety. Much of the trouble which housekeepers experience in making bread is due to the germs found in the flour, and not to any fault of the bread maker. This difficulty practically disappears when any of the various forms of unleavened bread making are employed. Germs are most troublesome in the making of raised bread and so-called "gems," or moist water bread, which are inferior breads at the best, and may be profitably discarded from the bill of fare.

Corn and Oats.

These splendid cereals rival wheat in their nutritive value, and are equally capable of sustaining life when properly prepared. Both of these are superior to wheat in the proportion of fat which they contain. This is particularly true of corn. The best varieties may be regarded as fully equal to wheat

in nutritive value. Neither of these grains can be used in making raised bread, for the reason that they contain no vegetable gelatin, though they are rich in other albuminous elements. They also contain an abundance of salts, or bone-forming elements, and are readily digestible when properly prepared. Both corn meal and oatmeal make excellent water breads, especially with the addition of a little wheat flour. They are best prepared in the form of thin cakes, which should be baked until slightly browned — so-called crisps. Ordinary corn bread and bannocks present the grain in an imperfectly cooked state, and are on this account not the most wholesome, though superior to ordinary raised bread.

The mushes, grits, hominy, and other forms in which corn and oats are commonly used, are perhaps preferable to coarse vegetables as food stuffs, but are by no means to be regarded as the best of foods. As commonly eaten with milk and sugar they readily undergo fermentation in the stomach. Experiments have shown that it is impossible to properly cook cereals by boiling in a kettle. The temperature is not sufficiently high to dextrinize the starch, which is consequently not prepared to undergo prompt and thorough digestion in the stomach.

Rye and Barley.

These grains, if slightly less rich in nutritive elements than wheat and corn, are nevertheless entirely wholesome, though geenrally less well liked than the grains previously mentioned. Rye contains a small proportion of gluten, and so can be used for making raised bread, though of inferior flavor. These grains may best be used in combination with wheat flour for securing a desirable variety of breadstuffs.

Rice.

Rice is one of the most widely used and useful of cereals. Some varieties are exceedingly poor in albumin or blood- and tissue-forming elements, consisting almost wholly of starch, fat being practically absent; but other varieties, which grow in high, dry regions, the so-called upland or mountain rices, contain quite a large proportion of proteids or albumins. As a rule, however, it should be understood that rice should be used in connection with other food stuffs that are rich in albumin, such as peas, beans, and nuts. As ordinarily prepared, rice is imperfectly cooked, and hence not the most easily digestible in the stomach, although it is digested with less difficulty than are the pasty mushes prepared from grains. When slightly browned before cooking, as elsewhere suggested, rice is an exceedingly wholesome, easily digestible, and nutritious cereal food.

Buckwheat, Kaffir corn, and various other seeds may be to a greater or less extent substituted for wheat, corn, and other cereals, but are in every way inferior to the splendid grains which have already been named, and their use should be for the most part confined to occasions of necessity or emergency.

Peas, Beans, and Lentils.

These splendid food products, though quite widely used, are certainly too little appreciated. By reference to any table of food values it will be noted that these seeds are exceedingly rich in albuminous elements, the proportion being about twice that of wheat and fifty per cent greater than that of beefsteak. In other words, a pound of peas or beans contains practically the total nutritive elements found in a pound of beefsteak, in addition to a still larger amount of other

food materials. The one element lacking is fat. This can be easily supplied by the addition of nuts.

The only objection which can be urged to the use of these excellent seeds is the fact that they are apparently less easily digestible than cereals. This fact is chiefly due, however, to the thick skin, which is so closely adherent to the kernel that it cannot be readily removed. Recently, however, methods have been devised whereby the hulls or skins of legumes of all sorts may be perfectly separated, thereby greatly shortening the length of time required for cooking, and increasing their digestibility. In the ordinary state, beans require five to eight hours' thorough cooking, and may be improved by still longer cooking. When deprived of their skins, they may be thoroughly cooked in less than half this time. The hulls of beans may be removed after thorough cooking by means of a colander.

The *pink bean,* which has been introduced into California from Japan, is one of the most nutritious of all known esculents. A Klondike miner told the author that while making an overland winter journey in the Klondike region, pulling a heavy sled, and performing the most arduous labor under difficult conditions, he found pink beans vastly superior to the finest moose steaks, canned meats, or any other food in strength-sustaining properties. The value of this food is clearly shown by the fact that of several thousand men who started on this same journey, the majority gave up in despair, hundreds died by the roadside, and only twelve men reached their destination; and these successful men, without a single exception, subsisted almost exclusively upon pink beans, the only additional food being a few crackers. They attributed their success to the wonderful sustaining powers of this pure

product of the soil, which experienced frontiersmen prefer to all other foods.

Peas, beans, and lentils possess, besides a high nutritive value, remarkable peptogenic properties, due to the large amount of soluble salts which they contain. They especially encourage the formation of acid when this element is deficient.

Peas and beans are best prepared by thorough cooking, and subsequent baking until nearly dry. By this means, the starch is utilized to some extent, and the food is thus prepared for prompt assimilation. Persons who have strong digestive powers may not find it necessary to remove the hulls, though this might be advantageously done in all cases. Persons who have slow digestion should never eat legumes of any sort without the removal of the hulls by passing through a colander. *Hulled beans* may be obtained at a moderate advance over ordinary prices from the Sanitarium Food Companies and supply stores.

The *soy*, or *soja*, bean of Japan differs from the ordinary bean in containing a large percentage of fat, which gives to it a composition similar to that of nuts. Its composition is intermediate between that of the ordinary bean and the peanut. It requires longer cooking, and is less well flavored than ordinary beans, which has prevented its general introduction as a food material in this country. It is possible, however, that this flavor may be improved by cultivation. This bean is employed in China and Japan in making ***bean cheese***, which is largely used in those countries.

EDIBLE FRUITS.

Cuvier, Sir Everard Home, and other comparative anatomists, assert that the diet of primitive man consisted largely of sweet fruits. Certain it is that there is no article of food for which healthy and unsophisticated human beings show greater relish than for fresh ripe fruit, an instinct which is shared with all the members of the monkey tribe, a class of animals which approach most closely to the human species, and with most other animals as well.

The abundant production of fruits in the summer months suggests the special value of this class of food during the warm season; but fruits are valuable at all seasons, not because of the large amount of nutritive material which they contain, for with a very few exceptions they consist chiefly of water, but because of their valuable nutritive properties, and especially the organic acids and peptogenic substances which they contain.

Fresh Fruits.

Green fruits are very much like vegetables, consisting chiefly of wood, water, starch, and tannic acid. During the process of ripening, or "cooking in the sun," as the Mexicans say,—"*Cocido en el sol,*"—the starch is converted into levulose, or fruit sugar, the sweetest of all the sugars, and vegetable acids,—citric, malic, or tartaric, according to the variety of the fruit. Thus, in ripe fruits there is no starch; fat is also absent, and the amount of albumin is so small as to be practically disregarded. Ripe fruit, then, practically consists of digested starch, or sugar, and fruit acids which require no digestion. It is, in other words, a digested food, the process

of digestion having been completed by the magic influence of the sun's rays during the process of ripening.

Fruit Acids.

The amount of acid in fruit varies. Some of the sweet fruits contain a considerable quantity of acid as well as those which are distinctly sour, the acid being simply covered by the considerable amount of sugar present. *Citric acid* is chiefly found in lemons, sour oranges, limes, shaddocks, grape fruit, and cranberries. *Malic acid* abounds in sour apples, pears, peaches, apricots, gooseberries, currants, also in cherries and other sour fruits. *Tartaric acid* gives to sour grapes their acid flavor. Some very sweet varieties of grapes contain almost no acid. The following table shows the nutritive value of the most common fruits, also the amount of acid contained in each of the most common fruits, and the percentage of sugar to one of acid: —

	Water	Proteid	Pectose	Fruit Sugar	Fruit Acid	Salts	Total Nutrit'e	Total Food Units in oz.
Whortleberry..	78.4	.8	9	5.	1.6	1.	9.3	18,900
Blackberry	86.4	.5	1.4	4.1	.2	.4	6.6	6,200
Raspberry	85.7	.4	.7	3.9	1.4	.5	6.9	5,800
Strawberry ...	87.6	1.1	.5	6.3	.9	.8	10.1	8,100
Gooseberry ...	85.7	.5	1.4	7.1	1.4 malic	.4	10.8	10,900
Cranberry.....	89.6	.1	....	1.5	2.3 citric	.2	4.1	2,800
Currant	84.7	.5	.9	6.4	2.2 malic	.7	10.7	9,200
Grape	78.2	.6	2.	14.3	.8 tart'c	.5	18.2	18,800
Cherry	79.8	.7	1.8	10.2	.9 malic	.7	14.3	14,000
Peach	80.	.7	7.1	4.5	.9 malic	.7	13.9	13,700
Apple	84.8	.4	4.8	7.2	.8 malic	.5	13.7	13,900
Pear	83.2	4	3.3	8.2	.2 malic	.3	12.4	13,600
Prune	81.2	.8	4.9	6.2	.8	.7	13.4	14,300
Plum	84.9	.4	4.6	3.6	1.5	.7	10.8	10,500
Apricot........	81.2	.5	6.4	4.6	1.2 malic	.8	13.5	13,700
Orange	86.9	.8	....	4.5	2.5 citric	.5	8.3	8,127
Lemon	89.2	1.0	....	8.3	7.5 citric	.5	11.3	9,695

The nutritive value of the organic acids is about two-fifths that of an equal weight of starch or sugar.

Erroneous Notions about Fruits.

There are many popular but unfounded prejudices against the dietetic use of fruits. It is generally supposed, for example, that fruits are conducive to bowel disorders, and that they are especially prone to produce indigestion if taken at the last meal. The truth is the very opposite of these notions. An exclusive diet of fruit is one of the best-known remedies for chronic bowel disorders. During the late war, large numbers of soldiers suffering from chronic dysentery were in several instances rapidly cured when abundantly supplied with ripe peaches. Fruit juice may be advantageously used in both acute and chronic bowel disorders. Care must be taken, however, to avoid fruit juices which contain a large amount of cane sugar. Juices of sweet fruits should be employed, or a mixture of sour and sweet fruit juices, or acid fruit juice may be sweetened with malt honey or meltose, a natural sweet produced from cereals. Raisins, figs, prunes, sweet apples, and pears may be mixed with sour fruits.

Indigestion sometimes results from the use of fruits in combination with a variety of other food substances; but fruits taken alone constitute the best possible menu for the last meal of the day. The combination of fruit, sugar, cream, bread, butter, cake, and pie may well produce bad dreams and a bad taste in the mouth in the morning. The use of fresh or stewed fruit alone without any addition whatever will produce no disturbance, and will leave no unpleasant effects behind to be regretted in the morning. Very acid fruits sometimes disagree with persons who have an excess of acid and those who are suffering from chronic inflammation of the stomach; but with these exceptions, there are almost no cases in which fruit may not be advantageously used.

The notion that acid fruits must be avoided by rheumatics is another error which is based on inaccurate observations. The fact is, rheumatics are greatly benefited by the use of fruit. At the same time they should abstain from flesh foods of all sorts, beef tea and animal broths, and all meat preparations, also tea and coffee, as well as alcohol and tobacco. It is, of course, possible for one to take an excess of acids, as one may take an excess of starch or any other food substances. Vegetable acids differ from mineral acids in the fact that they do not accumulate in the body, but are assimilated or utilized in the same way as sugar and allied substances.

Predigested Food Elements in Fruits.

Fruits have an advantage over all other foods in that they furnish to the animal, in a completely digested form, ready for immediate assimilation, such material as is needed to re-enforce muscular energy. To this fact is due the refreshment which is so promptly experienced by fruit juices when one is tired, and to the craving for juicy fruits under such circumstances. Most juicy fruits furnish not only water, but a small amount of digested food substance in the form of sugar which is taken at once into the blood, and being carried to the muscles, replenishes the stores of energy which have been reduced by activity, and so brings refreshment and re-enforcement of vigor and strength.

Fruits also aid the digestion of other foods by promoting the formation of the gastric juice, and particularly the production of pepsin.

Fruit Juices Destroy Germs.

Another advantage afforded by the use of fruits is the fact that fruit acids readily destroy nearly all germs. Typhoid fever germs, cholera germs, and other germs likely to produce

acute disease are quickly killed by coming in contact with dilute solutions of citric and malic acids. Lemon or sour apple juice destroys germs almost instantly. The juice of lemon added to an ounce of water may be relied upon to render the water sterile within half an hour, even though it may contain the germs of typhoid fever and cholera. This precaution may be advantageously taken by travelers, though, of course, it would be better to avoid all risk by using only boiled water when traveling. The antiseptic properties of fruit render it exceedingly valuable as a means of cleansing the stomach and the alimentary canal. The germs which grow in the stomach are all quickly killed when placed in the pure juice of fresh fruit. This explains the beneficial effect of the *grape cure,* the apple cure, the peach cure, and various other fruit cures which have been for many years practiced in Switzerland and other portions of Europe, and have more recently been employed in California, Ohio, and other parts of this country.

The Curative Value of Fruits.

The author has for a number of years made use of an exclusive fruit diet in the treatment of obesity, biliousness, and various forms of indigestion. In obesity an exclusive fruit diet for three or four days causes a rapid loss of flesh without any considerable amount of discomfort. Fruit fills the stomach, and stays the craving for food, while furnishing very little nutritive material. Acid fruits are preferable to sweet fruits for this purpose. It is a good plan for a person who is too fat to make his diet consist largely of fruit, taking other food only at the midday meal. Persons suffering from chronic biliousness may pursue the same plan. Fruit is the best food for the last meal of the day, as before indicated.

In fevers, fruits, especially in the form of fruit juices or fruit soups, are a most convenient food, and certainly the most appropriate of all foods. It is almost universally recognized as an established fact that beef tea and meat preparations of all sorts should be wholly proscribed in cases of fever, as the patient is already suffering from the accumulation of waste matters to such a degree that the addition of even the smallest amount contained in beef tea or a small piece of meat may be sufficient to give rise to an exacerbation of the disease and to lessen the patient's chances of recovery.

Fruit Soup.

German physicians make great use of preparations of fruit in fevers, particularly of *fruit soups*. In many parts of Germany, fruit soup is made by boiling for some time one part of dried fruit of some sort with four or five parts of water. In cases in which considerable gastrointestinal irritation exists, the soup or decoction thus prepared should be carefully strained, so as to entirely remove the skins and all other extraneous matter. A little cornstarch or rice flour may be added if desired.

Lemon juice, the juice of oranges, apples, cherries, grapes, raspberries, blackberries, and huckleberries, also the juice of tamarinds, currants, and cranberries may be added to water as a beverage in fevers. Thus used, they not only increase the quantity of water which the patient is able to drink, by giving to it a distinct and agreeable flavor, but also aid in the elimination of the poisons with which the system is struggling, by a slight diuretic action. Fruit juices used in the same way are likewise highly beneficial in Bright's disease and other forms of kidney disease in which it is desirable to increase and maintain the flow of urine. The grape fruit, the lime, the shad-

dock, and the pomegranate afford agreeable acid juices which may be used in the same manner. The antiseptic value of fruit juices must also be recognized as a positive benefit in these cases. The fever and most of the other symptoms present in typhoid fever are due to disease germs, which, growing in the alimentary canal, invade the blood and the tissues, and flood the body with virulent poisons, which work widespread and varied mischiefs. Beef tea, broths, and other meat preparations, eggs, and milk encourage the growth of these germs, while fruit juices destroy them.

Fruit Cure of Constipation.

There is no single article of diet of such great value in the treatment of intestinal inactivity or constipation as fruits. For this purpose, fruits must be eaten freely; and as a rule, in cases of this sort, it is better that the fruit should be taken at the beginning of the meal or a little while before eating. It is most effective when taken by itself in this manner. Raw apples, steamed figs, peaches, apricots, when not too ripe, prunes, oranges, and tamarinds are of greatest value for this purpose.

The Fruit Diet.

Person who employ a fruit diet for the relief of chronic symptoms, such as rheumatism, neurasthenia, sick headache, etc., should not expect to be cured by the use of fruit for a few days or a few weeks, but should adopt the free use of fruits as a regular practice. In cases of periodical sick headache, which are almost always connected with dilatation of the stomach, a patient may advantageously adopt, systematically, the plan of confining himself to a fruit diet for one or two days preceding the day of the expected attack. It may

be sufficient to confine the diet to fruit for one of the two daily meals, as for breakfast. Persons who require a fruit diet are generally benefited by the adoption of the two-meal-a-day plan, taking nothing after three or four o'clock in the afternoon, so that the stomach can be as thoroughly prepared as possible for the reception of food the next day.

If anything is taken later, it should be only some juicy, ripe fruit, as strawberries, oranges, peaches, or some similar fruit, containing little solid substance. Fruit juice alone is better. There are cases in which a diet consisting of fruits and nuts exclusively is of very great service. Almonds, pecans, filberts, or hazel nuts, hickory nuts, English walnuts, and chestnuts, are best for the purpose. Chestnuts must be cooked; other nuts may be eaten raw. They are more easily digested when crushed or ground to a paste. When thus prepared and mingled with fruits, the result is a very palatable, nutritious, and wholesome food.

There is no means by which a coated tongue may be so quickly relieved as by the exclusive use of fruit or fruit and bread. Fruit alone may be taken for a few days; or fruit only for breakfast, and bread with fruit and perhaps a moderate allowance of nuts at dinner. The more closely the diet is confined to fruit and bread, the more rapid progress will be made. The best form of bread is granose biscuit or graham zwieback or any form of water bread made from whole-wheat meal or graham flour.

When the exclusive fruit diet is followed, fruit may be taken four times a day. A considerable variety of fruit may be taken if desired. Care must be observed to masticate the fruit thoroughly, especially fruit having a firm flesh, as apples, pears, and cherries. Such fruits, swallowed without being reduced to a complete pulp by chewing, are likely to produce

fermentation and disturbances of the stomach and bowels. Those whose teeth are affected, in eating apples, especially, should take care to reduce the fruit to a pulp by scraping with a knife, or should adopt some other means of doing the work the teeth are unable to do in preparing the food to enter the stomach. It should be remembered that while a ripe apple digests in an hour or two, a green apple will not digest in any length of time, but must be treated as a foreign substance in the alimentary canal, and may create inflammation and other serious disturbances. Even the green apple, however, may be rendered digestible by thorough cooking.

We are often asked the question, "May fruit be given to young children or infants?" There can be no question that the juices of most fruits are well adapted to the digestive organs of young children. Fruits contain chiefly sugar and dextrin which are in a condition ready for immediate absorption. They furnish just the sort of material needed for building the plump little body which is characteristic of infancy, and padding up the tissues with a thick laver of fat for protection against cold, especially in winter.

Fruit a Cleansing Food.

The juices of fruits are highly valuable as a means of cleansing the stomach and alimentary canal. Disease-producing germs cannot grow in them to any extent. This is particularly true of the juices of raw fruits. Ripe fruits, such as strawberries, peaches, and even the scraped pulp of apples and pears, may be taken without injury by most infants a few months old. Cooked fruits, such as baked apples, prune purée, and other soft fruit pulps, may be used without injury free from cane sugar and not eaten with cow's milk.

Fruit should be taken at regular meal times, not between meals. It especially combines well with cereal foods. Very acid fruit juices should not be given to infants. The juice of sweet grapes, sweet apples, and other sweet fruits may be used freely by infants as well as by adults.

About the only caution which need be given in relation to fruits is, that they do not form a good combination with coarse vegetables. This fact explains many cases of serious gastric disturbance. Thoroughly healthy persons do not always need to observe the rule to avoid the use of fruits and vegetables at the same meal, but invalids, and especially persons with dilated stomach or slow digestion, will generally be greatly benefited by observing this precaution.

Fruits may be eaten either during, before, or at the end of the meal. Most persons, however, will profit by adopting the rule to eat juicy fruits only at the end of the meal. The reason for this is that cereals and all starchy food stuffs require very thorough mastication, and abundant admixture with saliva, not only to moisten them, but also to transform the starch after the food has entered the stomach, thus assisting in reducing it to an assimilable form and preparing it for the action of the gastric juice. When watery and especially acid fruits are taken with such foods, the flow of saliva is diminished and the action of the small amount of saliva produced is prevented, and thus the salivary digestion of the food in the stomach which occupies the first thirty or forty minutes of the digestive work done in the stomach does not take place, and indigestion is likely to result. If one, however, is making a meal of fruits and nuts, or predigested cereals in the form of malt honey, granuto, malted nuts, and similar preparations, this rule need not be observed, care

only being taken to secure thorough mastication, as there is practically no starch to be digested.

Fruit should be taken fresh, and soon after it has reached maturity. Canned fruit is inferior to fresh fruit. The same is also true of dried fruit. Still, both dried and canned fruit are far better than none, and with proper preparation dried fruit may render very great service if thoroughly cooked.

Each fruit has its own special adaptations and limitations. A few points in relation to each of the principal fruits employed as foods may be found of practical interest.

Bananas.

The banana is, aside from the date, the fig, and the raisin, which are dried fruits, the most nourishing of all fresh fruits. The amount of nutrient material contained in a pound of bananas is almost equal in sustaining value to that found in a pound of beefsteak. The amount of nitrogenous or albuminous substance approximates five per cent. In the dried banana, this proportion is about twenty per cent, or one fifth. Humboldt calculated that the banana, grown in suitable soil and properly cultivated, is capable of producing more food to the acre than any other plant. When well matured and ripened properly, the banana may be eaten by the most delicate invalid. Young children and even infants may sometimes be fed upon preparations of banana flour to advantage when no other food is well received.

According to Sergeant Parke, Stanley and his white associates subsisted almost exclusively upon banana flour for two years in the wilds of tropical Africa. The author is inclined to attribute to this fact, in a large degree at any rate, the success of these intrepid explorers in withstanding the almost

innumerable dangers and risks to life and health incident to travel in the portion of the world in which Stanley has rendered such great service as an explorer.

A gruel made of the dried banana flour is not only highly nutritious, but in the highest degree wholesome, and is tolerated when ordinary farinaceous preparations, milk, buttermilk, etc., are promptly rejected. The banana contains a small amount of starch, but this is so easily digested by the saliva that within an almost incredibly short space of time the digested mixture is found to contain a larger proportion of well-digested starch and similar substances previously existing in the banana not requiring digestion than can be produced in the same length of time with any cereal substance placed under the same conditions.

Bananas which have been picked so green that when found in the market they are wilted and tough, are entirely unfit to eat. Green bananas may be baked the same as apples, and are by some greatly relished when thus served, but the plantain is on the whole better suited for use in this way.

The Apple.

Apples may be eaten either raw, stewed, or baked. If eaten raw, apples should be thoroughly ripened, else through imperfect mastication large, hard masses of apple will enter the stomach, and give rise to fermentation or other disagreeable symptoms.

Ripe sweet apples will digest more quickly than any other raw food substance. A thoroughly mealy apple may indeed be looked upon as a dilute food substance, predigested, and ready for absorption. If reduced to a smooth pulp by thorough mastication before swallowing, it will pass out of the stomach within an hour, ready to undergo absorption in the intestine.

Baked sweet apples are digested by a person whose stomach will not tolerate any other fruit.

The acid of sour apples is an excellent corrective for foul conditions of the stomach, such as exist in biliousness. Apples are also a most excellent food remedy in constipation. When used for this purpose, they should be taken before breakfast, being eaten a quarter of an hour before the rest of the meal. Sour apples are better for this purpose than sweet.

Fresh apple juice is a most wholesome, nourishing beverage, greatly preferable to lemonade sweetened with cane sugar. Cider, or fermented apple juice, is highly injurious to the stomach, and easily interferes with digestion. Its unwholesomeness is due both to the alcohol and the acetic acid which it contains.

The Pear.

Pears may be cooked the same as apples, but are less useful in relieving constipation, and are not always so readily obtained. Pears have the advantage over apples in that they are usually of a sweeter and more palatable flavor, so that they do not require the addition of sugar, which is often added to sour fruit in excessive quantities, and so greatly to the detriment of the dyspeptic patient that fruit to which sugar has been added must be considered unwholesome and prohibited.

Peaches and Apricots.

These fruits are among the most easily digested of all raw products. The nutritive value is small, and they contain a considerable amount of woody matter, but their acid-sweet juices are exceedingly wholesome, and are often well received by stomachs which will not tolerate any other fruit, or at least

any other kind of acid fruit. Unfortunately, these fruits are very perishable, so the season of fresh supply is very short. It is easily possible, however, to lay in a good supply of these excellent fruits by preserving them in glass cans in the ordinary way.

Cherries.

This fine fruit is one of the most highly nutritious of all fruits. The nutritive value of the cherry is more than twice that of the peach, and is much greater than that of the apple or pear. The acid of sour cherries is also highly valuable as a remedy for foul conditions of the stomach and bowels. The sweet cherry has, of the numerous varieties of this fruit, the highest food value. The cherry has a firm, tough flesh, which must be carefully masticated to insure good digestion. Neglect of proper mastication is the principal cause of the indigestion which sometimes follows the eating of this fruit.

The Plum.

The plum in all of its varieties is a wholesome and valuable fruit. Sweet plums are of the greatest value, as they do not require the use of sugar, and are the most nutritious. In some varieties, the skin is so tough that it is as indigestible as paper, and should be rejected. Prune skins are often retained for many days in a feeble or dilated stomach. Prunes are best served in the form of a purée. They require very thorough cooking. The eating of prunes produces in many persons excellent laxative effects.

The Fig.

This tropical fruit is now cultivated to such an extent in many parts of the United States, as well as near-by-sub-tropical countries, that it may be quite readily obtained in the

fresh state during its season. The fresh fig is an easily digested, very nutritious, slightly laxative fruit. The dry fruit possesses all the properties of the fresh fruit, and is somewhat less easily digestible.

The Pineapple.

The pineapple, as well as lemons, oranges, grape fruit, tamarinds, guavas, pomegranates, alligator pears, sapodillas, and other tropical fruits, are as valuable as they are palatable, and ought to be freely employed when obtainable.

It should also be mentioned that pineapples in the form in which they are often sold in this country are quite indigestible if eaten raw. When allowed to mature upon the plant, this fruit is extremely palatable and luscious, and is almost as easily digested as the peach, although it contains considerably more woody fiber.

The Strawberry.

This is one of the most popular favorites of all the various berry fruits, and is generally well received by the most delicate stomach, if care is taken to avoid rendering it indigestible by the addition of cream and sugar, ice cream, etc. The better varieties of strawberries are sufficiently sweet, and require no sugar. They are best taken fresh, being less adapted to canning than almost any other fruit. The strawberry is said to contain a larger proportion of iron in its water-free constituents than almost any other fruit. There is occasionally a person who cannot eat strawberries because of some idiosyncrasy, as the result of which an exceedingly troublesome rash appears whenever these berries are eaten. Malt honey, beaten till white, is a most delicious dressing for strawberries or any other acid fresh fruit.

There is, perhaps, nothing better for checking hemorrhage from the stomach than the pure juice of one or two lemons swallowed quickly. Nosebleed may be stopped by snuffing lemon juice into the nostril from which the blood issues.

NUTS.

This highly important class of food stuffs doubtless constituted, in the early days of the race, the substantial portion of the bill of fare. Nuts are the most concentrated and highly nutritious of all food stuffs. Indeed, they may be considered to be the most valuable of all food preparation furnished in their natural state. The characteristic of most nuts is the absence of starch, the chief food elements being albumin and fat. In the process of ripening, the starch which was present in the green nut is converted into fruit sugar, as in the ripening of fruit. The fat of the nut is in a state of emulsion, and is found in the form of cream; hence, it is prepared to pass readily through the digestive process to be properly assimilated. The albumin in nuts is also a most easily digestible form of this food element. It does not form hard curds in the stomach, as does milk, but is quickly dissolved by the digestive fluids, and is ready for absorption.

It will thus be seen that nuts are among the most valuable of all food stuffs. Nuts and fruits constitute a complete dietary. Nuts and grains also form a perfect combination. Nuts and fruits furnish the food elements in a form which permits of their ready assimilation, and in part predigested; the fats being emulsified and the starch being converted into sugar, the albumin alone remains to be acted upon by the gastric juice. Cereals and nuts form a less perfect dietary, and one possibly to some extent less well adapted to man's use.

A diet of fruits and grains is to some degree inadequate for the reason that they are deficient in fat. Nuts, hence, become for those who discard the use of meats and other animal products, very essential as a source of fat, one of the three most important food elements. Nuts also constitute an exceedingly valuable source of albumin, which is deficient in all fruits and in some grains, especially rice.

With these facts in mind, it is apparent that nuts may be properly called the vegetable analogue of meat. They are truly meat in the proper sense of the term, original meat of the sort referred to in Gen. 1:29, "To you they shall be for meat." A pound of nuts, almonds for example, contains almost as much albumin as a pound and a half of beefsteak, besides two thirds as much fat as a pound of butter.

The Almond.

Almonds are exceeded in nutritive value by no other food known, except one or two nuts, which have a slightly higher percentage of food elements. The most abundant element of the almond is its highly digestible fat, which constitutes fifty-three per cent of the total weight of the nut. The almond contains twenty-one per cent of a remarkable nitrogenous substance of a chemical composition resembling gluten, but differing from it in the fact that it is more readily soluble in the digestive fluids, and also in the possession of remarkable emulsifying power. It is to the presence of this emulsifying principle that the almond, when ground to a paste, owes its property of being readily convertible into a delicious cream or milk simply by the addition of water. Almond cream or so-called almond butter, prepared from crushed almonds, is a most delicious substitute for cow's milk. It has an advan-

tage over animal products in that it does not form large, tough curds, and hence is not retained for an indefinite length of time in the stomach, producing biliousness, acidity, gaseous distention, and other gastric disturbances.

The Pecan.

The pecan is a variety of the hickory nut or walnut. It is not surpassed in digestibility by any other nut, and the large amount of fat which it contains gives it a high nutritive value.

The Walnut.

The walnut, of which there are several varieties, is especially desirable for its delicate flavor, which combines well with that of bread and grains. Crushed fine, they make a highly nutritious foundation for the meat of sandwiches and for the flavoring of cooked vegetables and grains.

The Filbert.

The filbert has a much higher usefulness than has yet been accorded it. It is closely allied to the hazelnut. The flavor is delicately sweet and the meat dry and fine-grained. It contains about half its weight of an easily digestible fat.

The Peanut.

Strictly speaking, the peanut is not a nut at all, but a leguminous seed. Botanically, it is more nearly related to the pea or lentil. The composition of the peanut, however, differs very greatly from that of any leguminous or farinaceous seed. All legumes as well as cereals contain a large proportion of starch or carbohydrates; in wheat, rye, barley,

oats, corn, and rice it varies from fifty-eight per cent in oatmeal to seventy-eight per cent in rice. Legumes — peas, beans, and lentils — contain from fifty per cent to sixty per cent of starch; while the peanut contains, as stated by some authorities, less than two per cent of starch. This element is replaced in the peanut by fat, which is present to the amount of over forty-six per cent, or nearly one half its weight. The botanical name of the peanut is Arachis. It is sometimes called the "underground kidney bean." It is also called by various other names, as groundnut, earthnut, monkey nut, American nut, mandubi, goober, Manila nut. In the streets of Cairo this nut is peddled by the Arab boys in the raw state, under the name of the Soudan nut. Its use is known in many countries, France, Spain, Peru, Europe, America, Africa, India, China, Japan, and the Malay Archipelago, and it is rapidly becoming one of the important articles of commerce. The Chinese peanut, which is smaller and more palatable than those grown in the United States, is considered in some parts of China one of the four essential things which every man must have as necessary to life.

The general prejudice against the use of nuts on account of their supposed indigestibility is due to two things: first, their use at improper times, between meals, or when a sufficiency of other food has already been taken; and second, their imperfect mastication. As commonly presented for use, they are dry and brittle, and hence easily escape mastication. When swallowed in small bits, they are practically indigestible. Experiments made by the German government show that even very small particles of nuts pass through the alimentary canal entirely unchanged. The mastication of the nut should be so thorough that it will be converted into a

creamy pulp before it is swallowed. When chewed in this thorough manner, all nuts are easily digestible. The chestnut and the peanut must be cooked, because of the raw starch which they contain.

In order to secure thorough mastication, it is well to combine with nuts, when eating them, crackers, zwieback, granose biscuit, or some other similar hard, dry cereal food which will aid in securing thorough mastication. This difficulty is overcome by converting the nut into a paste, or so-called nut butter, by crushing or grinding in a suitable mill. Filberts or hazelnuts, almonds, and peanuts are best for this purpose, for the reason that the indigestible skins can be removed by mechanical processes. Almonds, filberts, and pecans, as well as other nuts, may be eaten raw or made into a butter after slightly cooking. Peaunts require thorough cooking. Roasting, however, is an objectionable method of cooking, for the reason that a few small nuts or particles of nuts are certain to be burned or overheated, and the result is the formation of cresylic acid and other irritating substances. The best peanut butter is made by steaming or boiling peanuts, drying them, and then converting into a paste by grinding or crushing them. By the exercise of great care, the nuts may be cooked in an oven employing moderate heat, and putting a large pan of water in the oven at the same time. The nuts may be steamed for several hours, dried, and then ground.

To cook peanuts: Blanch the raw nuts, and introduce into the boiling water in the proportion of one pint of the blanched nuts to two quarts of water. Put them in an earthen jar or bean pot, allow them to come just to a boil, and bake in a slow oven, continuously if possible, for eight or ten hours, until the nuts are very soft and the water mostly evaporated. A tin oven over a kerosene-lamp stove furnishes an excel-

lent means for cooking the nuts with almost no care and expense; but a managing housewife will not find it hard to cook them at a time when fire is needed for other purposes.

When the nuts are done, rub through a fine colander or sieve, add salt if desired, and utilize for gravies, seasoning of soups and vegetables, as a substitute for butter on bread. and for every other purpose for which a nut butter is needed. The pulp will be of a coarser grain than manufactured nut butters, but it serves as a very fair substitute when these cannot be obtained of good quality. Most of the nut butters sold ready made are carelessly prepared and unfit for food.

If desired, the nuts may be lightly browned (not roasted) before cooking, and the product will be a very tasty food. If kept in a cool place, it will remain fresh for several days. By moistening and reheating in an oven for half an hour every two days, it may be kept fresh for weeks.

The Chestnut.

Chestnuts differ from nearly all other edible nuts, in the fact that they contain little fat and a very large percentage of starch. They may be boiled or roasted. A convenient plan is to begin the cooking by boiling and finish by roasting in the oven. Prepared in this way, they are not so dry as when roasted alone. American chestnuts are sweeter than the Italian, but on account of the larger size, the latter are generally preferred for food purposes. In Italy, the chestnut is largely used as a substitute for wheat and other cereals. In some portions of the country, especially in Lombardy, this nut is made into a meal, which is formed into cakes, which serve as bread.

The Cocoanut.

The cocoanut is more extensively used, perhaps, as a food than any other nut. In certain of the Pacific Islands, it constitutes almost an exclusive dietary. Cows, dogs, donkeys, chickens, in fact almost every living thing, even certain species of crabs, live on the cocoanut, ingeniously working a way to the meat through the one open eye of the nut. In the country where it grows, the cocoanut is very largely eaten in the half-ripe state. At this stage, the meat is jelly-like in consistency, and may be eaten with a spoon. It is very toothsome and nourishing. The meat of the ripe nut is very hard to digest, and can scarcely be masticated sufficiently to prepare it for entering the stomach. The best use which can be made of the meat of the ripe cocoanut is in the preparation of cocoanut cream, which is an excellent substitute for butter. This may be easily accomplished by the following method: Remove the meat, and put it through an ordinary vegetable shredder. Pour over the pulp twice the quantity of boiling water, and let stand for half an hour; then strain through a fine cloth, and let the milk so obtained stand for three or four hours in a cold place. A rich cream rises, which may be used in the same way as dairy cream, or, like ordinary cream, may be worked into butter.

VEGETABLES.

There is less to be said concerning this class of food stuffs than in relation to the preceding, for the reason that notwithstanding the great variety of vegetable substances which are used as foods, and which are not included under the head of fruits, nuts, and grains, there are comparatively few which are of any considerable nutritive value, and especially few which can be recommended from a health stand-

point. Practically the only vegetables which are worthy of any prominent place on the bill of fare are the Irish potato, the sweet potato, and unripe peas, beans, and corn, which, though not properly vegetables, are commonly classed as such.

Vegetables are unquestionably a valuable article of food, but it needs only a superficial study of the subject of dietetics to make it clear that vegetables are very greatly inferior to grains in nutritive value, and in their composition are far less suited to the human stomach than are the seed products commonly known as fruits and nuts. An interesting fact, also, is that, considered from the standpoint of comparative anatomy, man's digestive organs are very different in structure from those of animals which subsist upon roots, leaves, buds, twigs, stems, and other products included under the general term of "vegetables." Another fact of very great interest in this connection is that vegetables were not included in the original bill of fare given to man by his Creator, as recorded in the first chapter of Genesis (Gen. 1:29). Herbs were given to the lower animals for their sustenance, while seeds and fruits were reserved for man.

Seeds and fruits are the most highly elaborated products of the vegetable kingdom employed as food. Vegetables are much coarser in character and much less perfectly elaborated. Nearly all vegetables contain a large amount of woody matter, which requires the action of very powerful digestive juices and of strong muscular action on the part of the digestive organs to reduce them to a fluid state, and to extract from them the comparatively small amount of nourishment which they contain. To a much less degree is this the case with fruits and grains, while in the case of fruits, we find food substances more nearly prepared for assimilation and in a

form more easily dealt with by the digestive organs of man than any other.

The author has met many cases in which invalids were really suffering, and that seriously, from ignorance of these facts. To a person in vigorous health and with strong digestive powers these principles may be ignored with comparative impunity for a long time; but a person whose digestive powers are feeble, especially one suffering from dilatation of the stomach,— an extremely common condition, especially among women in consequence of their injurious mode of dress,— often suffer seriously as the result of the great labor required of the digestive organs by the use of such coarse vegetable products as celery, lettuce, and salads of various sorts. In some instances, vegetables which grow underground, roots, such as parsnips, beets, turnips, and such coarse substances as the cabbage, celery, spinach, and various sorts of "greens," are the only articles which need to be excluded from the dietary, while in others all vegetables are a source of serious digestive disturbances.

The comparative indigestibility of vegetables may be in large part due to a deficiency of peptogens in these substances. This difficulty may be in part overcome, however, by proper cooking and combining peptogenic substances with vegetable products. Potatoes which have been very thoroughly baked or browned in an oven are strongly peptogenic, while boiled potatoes are not. Broths and purées of peas, beans, and lentils are also peptogenic, likewise nuts and malt honey or meltose.

Food Combinations.

With many persons the principal evils arising from the use of vegetables are rendered conspicuous only when these

articles are consumed in connection with others with which they do not well agree. Many persons have recognized that various articles of food can be eaten separately or with certain others, while in other combinations they prove extremely unwholesome. The reason for this is the fact that fruits and vegetables require digestive action so different in degree and kind. A ruling principle in relation to the combination of foods is this: Those articles of food should be eaten together which are digested together. In other words, the bill of fare should be so arranged that the combination of food substances will harmonize with the action of the digestive organs upon those substances.

In applying this principle to vegetables, we find that the starchy vegetables are hard of digestion, and that the large quantity of potash salts which they contain is, according to Bunge, a source of irritation to the stomach, and interferes with gastric digestion. The coarse, woody structure of nearly all vegetables also renders necessary the retention of the digested mass in the stomach for a long time, thus lengthening the time of disintegration.

In the case of fruits, on the other hand, when ripe and properly cooked, we have substances which are digested and assimilated with very great ease. The time required for the digestion of cabbage is between four and five hours, while a ripe apple digests in one hour. If these two articles are taken into the stomach at the same time, both must remain there until both are digested, as they will become so intimately intermingled that they cannot possibly be separated. The apple, digested and ready to be passed on, is in part retained, and so ferments. It is a principle which is constantly recognizable in relation to digestion, that the delay of the

absorption of a food product after it has been digested is certain to result in its deterioration through fermentation and decomposition, which are set up by the numerous microbes constantly present in the alimentary canal. The same is true if the digestive product of one portion of the alimentary canal is not passed along with due promptness to another part of the digestive apparatus, where its further elaboration is to take place preparatory to absorption. The reason for this is found in the fact that after the work of the digestive fluid is done, it is absorbed, thus leaving any food stuffs which may remain in the stomach subject to the action of yeasts and germs.

The combination of fruits and vegetables is, for the reasons given, one of the most unsuited of all combinations for a person of feeble digestive powers. As before remarked, persons with dilated stomachs are especially likely to suffer from the use of vegetables, and still more so from the combination of vegetables with fruits, for the reason that with these persons there is necessarily a considerable delay of the food in the stomach in consequence of the weakness of the muscular walls of the stomach, and hence inability of the organ to empty itself with due promptness. Vegetables alone are much less likely to ferment, for the reason that they contain very little material capable of fermentation, the opposite of which is true of fruits.

It is quite clear that vegetables might be wholly eliminated from the bill of fare for human beings without any serious loss. Still, for healthy persons, these esculents are sometimes valuable, as they afford an opportunity for an agreeable change in the bill of fare.

The Potato.

The starch of the potato is more easily digestible than that of cereals, as has been shown by numerous experiments conducted in the experimental laboratory of the American Medical Missionary College, as well as by eminent German authorities. The ordinary manner of cooking the potato, however, imperfectly prepares the starch for the action of the saliva, and at the same time facilitates its passage through the mouth into the stomach without the proper admixture of the saliva necessary for its digestion. There is thus a double disadvantage, which is quite likely to lead to fermentation in the stomach and the formation of acids and gases, especially when the action of the saliva upon the starch is still further interfered with by acid fruits. This applies equally well to all other starchy vegetables. When the vegetables are reduced to a powder by drying and grinding, then made into biscuit with wheat flour or by other means, and baked until slightly brown, these farinaceous substances are found to be quite as easily digestible as cereals prepared in a similar way. The digestibility of potatoes may be greatly increased by cooking, cutting into slices, then placing in an oven until slightly browned. The admixture of fat of any sort should, however, be carefully avoided during the baking. Nut cream, or properly prepared nut dressing, or some other fat-containing material may be added as a dressing in serving. Potatoes must be ripe and mealy to be well digested.

Green peas are highly nutritious. Well-cooked, tender *asparagus* shoots and *cauliflower* seldom cause gastric disturbances. *Green corn* is more easily digested, when properly cooked, than is ripened corn. It is probable that primitive man made free use of cereals in the milk stage. At this stage of its development, the seed contains a large amount

of dextrin and sugar. These elements have not yet been converted into the insoluble starch, and hence are more perfectly adapted to the human digestive organs. One of the purposes of cooking is to bring the starch back to the state of dextrin, thus increasing its solubility and digestibility.

The *cabbage* is less likely to create gastric disturbance when eaten raw than if cooked. The reason for this is that raw cabbage, the substance being still alive, ferments less rapidly than the cooked cabbage which is dead. The raw cabbage may remain in the stomach quite as long, and probably is even less digestible by the gastric juice than the cooked cabbage, yet its slowness to take on fermentation enables it finally to escape into the intestine before fermentative or putrefactive processes begin. The food value of cabbage is so small that it is hardly worth eating. The same remark may be made with still greater emphasis in relation to such grass-like foods as *celery, spinach,* and *"greens"* of all sorts. *Onions* have quite a high nutritive value, but are spoiled by the presence of an extremely acrid and irritating volatile oil. At best, the onion can be tolerated only in minute quantities as a flavoring substance. A well-bred, hygienic palate will be quite willing to dispense with this noisome-smelling vegetable. *Mushrooms,* though belonging to the vegetable kingdom, must be regarded as unfit for human food. They do not manufacture food elements as do proper food-making plants, but are parasites which subsist upon the decomposing remains of other forms of life, and eke out a miserable, scavenger existence on this secondhand diet. The meaty or flesh-like odor of the cooked mushroom should arouse suspicion, and brand it as a secondhand source of nutriment, like the swine and other scavengers.

The Tomato.

The tomato, while botanically a fruit, is generally associated with vegetables. Its acid flavor allies it with fruits, while its coarse structure gives it decided affiliations with vegetables. It is unquestionably a good food, though somewhat more likely to disagree with sensitive stomachs than the more refined fruits which grow on trees and shrubs. Raw tomatoes must, on the whole, be regarded, from a dietetic standpoint, as an acid vegetable.

Milk.

Milk is commonly regarded as one of the most wholesome and easily digested of all foods, but this is true only in a modified sense. The members of each class of warm-blooded animals provide food for their young exactly adapted to their needs. Cow's milk is adapted to the stomach of the calf and its nutritive requirements. The calf's stomach is a very complicated apparatus, being, in fact, a group of four stomachs, rather than a single organ. It is intended to digest coarse and bulky materials, such as grass, twigs, and leaves. Cow's milk adapts itself to such a stomach, forming large, tough curds, which are easily enough digested by the calf, but which in a human stomach often become the source of great mischief, as the simple stomach of human beings, old and young, is adapted to the digestion of substances which are more easily dissolved. The natural food of the human infant accordingly forms small, soft curds, which are quickly dissolved in the digestive fluids. The milk of goats is more difficult to digest than that of the cow. Thousands of infants die annually because of indigestion set up by the use of cow's milk, and thousands of human beings, probably nearly half of all adults, are more or less injured

by the use of cow's milk, which produces biliousness, sick headache, coated tongue, inactive bowels, and a variety of other disturbances. These are not all due to the toughness of the curds formed in the stomach, but are partly the result of the great numbers of germs which are always found in milk, and which grow and set up fermentation and putrefaction in the stomach, unless the milk is thoroughly cooked before eating.

Many persons have noted that the eating of milk gives rise to acidity or flatulence, or both conditions. This is due to the fact, lately pointed out by an eminent European observer, that lactose, the sugar of milk, while easily digested by infants, is not well digested by adults, because the latter do not possess the proper digestive ferment, and hence ferments.

The conditions under which milk is produced renders it especially liable to contamination with germs. It is to these germs that cholera infantum is due, also most of the intestinal disorders from which young infants suffer at all seasons of the year, and especially in the summer. The United States Department of Agriculture, in its Bulletin No. 25, gives the following description of the sediment that is found in milk: "This dirt is largely composed of manure, but the microscope has also revealed undigested hay, molds, hair, shavings, woolen threads, linen threads, earth, cobwebs, particles of skin, human hair, pieces of insects, and down from birds."

Milk Germs.

The number of germs found in milk varies in different localities. In Boston an examination made some time ago showed the average number of germs to the drop to be 160-000. Other observers have found as high as sixty millions to the drop. Competent authorities declare that in Euro-

pean cities the number of germs found in milk is rarely less than 150,000,000 to the ounce, and sometimes reaching the enormous number of 5,400,000,000 to the single ounce. These germs are not all capable of producing definite disease like typhoid fever, or other recognized maladies; but they give rise to putrefactions by which poisons are formed, and the absorption of these gives rise to headache, lassitude, and a variety of unpleasant symptoms, besides setting up fermentations of other food substances with which the milk is eaten, thereby lessening their value, and giving rise to chronic indigestion in various forms.

Diseases Due to Milk.

Typhoid fever, diphtheria, cholera, tuberculosis, and other diseases are easily transmitted from animals to human beings through the medium of milk. Dr. Salmon, who stands at the head of the Bureau of Animal Industry of the United States Department of Agriculture, in a paper before the American Medical Association (1891), stated that two or three in every hundred cows in the United States are suffering from tuberculosis, and at least one in every hundred is so affected as to contaminate the milk with tubercle germs. These germs are especially liable to affect young children, giving rise to tuberculosis of the bowels, and to other forms of tuberculosis to which children are especially subject. In some European countries half of all the cows are affected with this dreadful disease, and in some parts of the United States the proportion is nearly as large. Tuberculosis is rapidly increasing among cattle, and the time is probably not far distant when a large proportion of cows in all civilized communities will be infected with this disease. One way in which the disease is rapidly extending among cattle is the

following: In districts where large dairies are conducted, many farmers carry back the skimmed milk and feed it to the calves, after the cream has been separated. In the dairy, the milk is mixed together, so that if there happens to be at the beginning a single infected cow in the herd, it is not very long until the infection is communicated to all the herds in the district which are furnishing milk to the same dairy.

It is evident that if milk is to be used, it must be cooked before eating, unless obtained from cows known to be perfectly healthy. The only way to determine that a cow is not subject to tuberculosis is by the injection of tuberculin, which must be done by an experienced veterinary surgeon. The fact that a cow has been raised on the premises is no guarantee that the animal is healthy. Cows kept in stables or confined in yards where they have little exercise are certain to become diseased sooner or later, as these animals are very subject to tuberculosis, much more so even than human beings.

If sufficient care is taken in the milking, a large proportion of the germs may be excluded. For this purpose, however, it is necessary that great care should be taken that the cow is kept thoroughly clean, by an abundant supply of bedding and a daily grooming and washing. Every farmer knows that a horse must be groomed daily and exercised regularly to be kept in a state of health and vigor. This is just as true of cows as of horses, but it is rare indeed that a cow enjoys such advantages. The animal is commonly shut up in a closed stall or small yard, and is fed, watered, and milked. The idea seems to be to treat the cow as a sort of filter through which the hay, cabbage, potatoes, bran, and slops of various sorts — often including swill from the house or some neighboring hotel — is filtered, and somehow trans-

formed into pure, sweet milk; but unfortunately the transformation does not take place in this way. Milk always partakes more or less of the nature of the material from which it is made. This is amply demonstrated by the flavor imparted to milk by such rank-smelling foods as leeks, turnips, and onions.

The cow often suffers from indigestion. The milk of a dyspeptic cow is quite unfit for human food. It is a well-known fact that a nursing infant is very likely to become sick if the mother happens to have a fit of indigestion. If the mother is febrile, the child is likewise febrile, irritable, and peevish. The cow fills the office of wet nurse to the whole family, and sustains the same relations to all who make use of her milk as does the mother to a nursing infant. This patent fact appears to be little regarded. If cow's milk is to be used, the animal must be surrounded by the most thoroughly hygienic conditions. The food must be selected with the greatest care, and the animal's health promoted by pure water, fresh air, proper exercise, daily grooming, and thorough cleanliness.

Milk and its products are unquestionably the most filthy articles which come upon our tables. Milk generally contains the dung of animals in such quantities that straining is necessary before it can be even tolerated, and after ordinary straining the last drops from the pitcher are always found to contain a very disgusting quantity of stable cleanings.

Cow's Milk Not an Essential Food.

While it may be impossible at the present time to dispense with milk altogether as an article of food, its use is certainly questionable, and it must be regarded as inferior ot the natural products of the earth, and so likely to produce

disease that its use should be as limited as possible; when it is clearly productive of evil effects, as in those who suffer from headache, coated tongue, constipation, or chronic biliousness, its use should be discarded altogether.

Cream in moderate amount, if well sterilized by boiling, is less likely to produce evil effects than milk. For sterilizing milk or cream it is necessary that it should be heated for fifteen or twenty minutes at a temperature sufficient to produce a slight scum upon the surface. This will destroy typhoid fever germs and the germs of tuberculosis, but it will not destroy the manure germs, which are the cause of bowel troubles, especially in young infants, and are probably the principal cause of biliousness. These germs are not destroyed even by ordinary boiling. To completely destroy them, milk must be boiled for half an hour three days in succession. After sterilizing, milk should be cooled as quickly as possible.

Filberts, almonds, and other nuts furnish such excellent substitutes for milk, that this article of food can be dispensed with without the loss of any essential food substances. For this purpose it is only necessary to blanch the nuts, then remove their skins, reduce them to a paste or nut butter, and then dilute them with water to the proper consistency. Water should be added gradually, so that the mixture may be smooth. Prepared in this way, nut cream or milk is almost exactly the same in composition as cow's milk, it is equally nourishing, and is much more easily digested. It has the advantage that it is thoroughly clean and free from any taint of germs or contamination of any sort.

Buttermilk.

Buttermilk, like sour milk, is much more easily digested than ordinary milk, and may be eaten by those who are made bilious by ordinary sweet milk. Buttermilk should be made from sweet cream, however, and should be eaten while perfectly fresh. So-called cottage cheese, made from curdled milk, is also more easily digested than ordinary milk. It is better to curdle milk by the addition of lemon juice than to allow the milk to sour spontaneously, as sour milk is swarming with germs of many sorts.

Butter Germs.

In this connection it is interesting to note that butter is even more likely to be infected than milk, or, at any rate, is infected to a greater extent. It has been shown that about ninety-nine per cent of the germs which grow in milk are carried to the surface with the rising cream. The germs are captured in the particles of fat, and in the process of churning, they are incorporated with the butter. Thus it is apparent that if butter is to be used as an article of diet, it must be made from sterilized milk or cream. It has been shown that tubercle germs and the germs of typhoid fever live for several weeks in butter made from milk containing these germs. There are other reasons why butter is an objectionable article of diet, which will be considered elsewhere, but the fact above stated is sufficient reason for condemning cow's butter as a decidely questionable article of food. Such excellent butter may be made from nuts of various sorts, that it is really quite unnecessary to resort to the use of cow's butter when one has once become accustomed to the use of the various nut preparations which can be easily substituted for it.

Cheese.

After what has been said, it is hardly necessary to add anything respecting the use of cheese. Yet it is an article which enters so largely into the ordinary dietary, appearing as regularly as bread on many tables, that it seems necessary to add a few words.

Every eater of cheese ought to be informed of the fact that ripe cheese always contains poisonous substances, produced by the action of germs. These are not ordinarily present in sufficient quantity to render their presence apparent by seriously toxic symptoms; but the fact that the cheese-eater may at any time swallow unawares a fatal dose of cheese poison, or a dose of sufficient size to imperil his life and entail great suffering, is evidenced by the frequency with which cases of cheese poisoning are reported. Some years ago, more than two hundred cases were reported to the State Board of Health of Ohio, all occurring within a few days. The symptoms were vomiting, great pain in the stomach, and violent purging, lasting from twelve to forty-eight hours, great prostration, and in some cases syncope.

Cheese Germs.

According to Professor Adametz, perfectly fresh cheese contains to every gram (fifteen grains) from 90,000 to 140-000 microbes. The population of a soft cheese twenty-five days old was found to number 1,200,000 for every gram (one thirtieth of an ounce), while the same quantity of a cheese forty-five days old was found to contain 2,000,000 microbes. One soft cheese examined was found to contain, near its outer surface, from 3,600,000 to 5,600,000 germs in a quantity of cheese barely equaling in size a small marble. Combining many observations, it was found that cheese, on

an average, contains in every pound nearly twice as many germs as there are people upon the face of the globe.

Cheese must certainly be ruled off our tables as unfit for human food. The skippers and mites which cheese often contains are evidence that it is food for scavengers rather than for human beings. Skippers are simply the larvæ, or maggots, of a species of fly, which smells the cheese from afar, and deposits its eggs in it, as other species of flies deposit their eggs in the bodies of dead animals, so that the young larvæ may find suitable sustenance close at hand,— one of the wonderful provisions Providence has made for the disposal of decomposing matter.

How strange that man should have so debased his instincts and perverted his appetite that he can consider a morsel of rotting milk filled with scavenger creatures so great a delicacy that he is willing to swallow it, scavengers and all! It is indeed pleasant to turn away from these germ-infected foods derived from the animal kingdom, and feast our eyes upon the pure germ-free products of the trees and shrubs and the waving fields of grain, and know that in receiving these bounties straight from Heaven's hand, we are taking into our bodies those substances which are in the highest degree calculated to replenish strength, vigor, and tissue waste, without incurring the risk of injury or contamination of any sort.

The Use of Milk by Savages.

It is a fact that milk is very little used by wild or semi-savage tribes. Most savages who use milk at all — and the same may be said of nearly all Orientals and of many Europeans — decline to use it in its natural state, but allow it first to undergo fermentation, by which soft curds are formed, which are easily broken up in eating. Milk taken in this

way, that is, in the form of curds or sour milk, is much less likely to give discomfort than when taken in its ordinary fresh state. Probably the majority of human beings who make use of cow's milk take it in this way.

A man carrying a dozen or more pans of sour milk, which he sells under the name of matzoon, is a common sight in the streets of Constantinople. One always finds sour milk in the dairy shops of German cities.

Vegetable Milk.

Many savage tribes obtain milk supplies from vegetable sources. The milk of the cocoanut furnishes a satisfactory substitute for cow's milk to the teeming millions of many tropical countries; while the cow-tree of South America provides a vegetable milk so rich in fatty matter that it might be more properly called "vegetable cream."

Milk and Cream from Nuts.

All nuts contain fats in a state of emulsion; they also contain a large percentage of proteid matters. By crushing and mixing with water, a solution closely resembling milk may be made from most kinds of nuts. The amount of fat and proteid substances contained in such a solution does not differ very greatly from the proportions in which they are found in milk. Such a preparation made from almonds contains all the elements of nutrition, and in proportions better adapted to the wants of human beings than does cow's milk. The fat which it contains is present in a state of perfectly natural emulsion. The proteid or albuminoid substances, corresponding to the albumin and casein of milk, are practically identical with the casein of mother's milk, and form in the presence of an acid, extremely fine and soft curds, which

break up with the greatest readiness. In this respect, it is even superior to the natural food of the human infant.

Almond milk has a delicate flavor, with a suggestion of its nutty origin, but resembling cow's milk very closely. It agrees with the most delicate stomachs, and can be taken with perfect impunity by persons who cannot take cow's milk or cream, even in the smallest quantities, without suffering more or less severely in consequence. Added to cow's milk nut cream prevents the formation of hard curds.

For most adults, and even infants, milk or cream made from crushed nuts is a good substitute for cow's milk.

Eggs.

Of all forms of animal food, fresh eggs are probably open to the least objection. In composition, eggs closely resemble nuts and other oily seeds. They are in fact the animal analogues of seeds. When perfectly fresh, and when obtained from fowls which have been properly fed and housed, eggs can hardly be considered as objectionable from a hygienic standpoint. Careful chemical analyses have shown that when perfectly fresh, and before incubation has begun, eggs do not contain the slightest trace of poisonous substances such as are always found in animal tissues. Even uric acid, which is always found in the flesh of animals, is absent from newly laid eggs, but appears as soon as the process of incubation begins.

The average egg contains one ounce of white, one-half ounce of yolk. Ten eggs equal a pound of meat in nutritive value. The white of egg is six sevenths water, one seventh albumin. The yolk of egg is one sixth proteid or albumin, one third fat, and one half water. Eggs contain a large amount of lime and iron. Fifteen eggs furnish the amount

of proteids required for one day; nine eggs, the amount of fat. One dozen eggs and eighteen ounces of zwieback or two pounds of bread furnish a day's ration for an adult.

It must be remembered that eggs are extremely liable to deterioration. A fresh egg is a live young animal in embryo. It is easily affected by extremes of heat or cold. A dead egg very quickly undergoes decomposition as does a dead animal. Stale eggs are as poisonous and as unfit for food as animal flesh which has begun to decay. The difficulty of obtaining eggs which are perfectly fresh, and the practical impossibility of knowing in advance that an egg is altogether wholesome, also places this class of food under suspicion.

It should also be mentioned that eggs are a concentrated albuminous food, and hence when used, must be taken in moderate quantity, as injury from excess of proteids or albumin may easily result when they are allowed to form too large a part of the diet. Eggs are often spoiled in cooking. Fried eggs, omelets, and hard-boiled eggs are extremely difficult of digestion. A thoroughly beaten egg is very easily digested. Poached, soft-boiled, and curdled eggs are also very easily digested. Curdled eggs are prepared by placing whole eggs in water at a temperature of about 180° F. The containing vessel should be put aside where the temperature cannot rise. At the end of thirty or forty minutes the albumin of the eggs will be found in the form of a soft jelly, which is much more digestible than the hard masses formed by cooking in the usual manner.

Hard-boiled eggs are very quickly digested if finely divided by thorough chewing with zwieback, toasted wheat flakes, or other dry foods.

Raw eggs remain longest in the stomach if swallowed without beating.

Shall We Slay to Eat?

THE question is not, "Is it possible to subsist upon the flesh of animals, and live?" but, "Is it natural, wholesome, and wise so to do?" In other words, is it in harmony with the divine order of life for man to slay to eat? We have not space in this small volume to enter into a full discussion of this question, as has been done elsewhere.[1] We shall merely undertake to summarize the facts of science and experience in relation to this great question, and to draw such instruction as we may from the teachings of Holy Writ.

The diet of every class of animals is adapted to its structure and to its needs. This fact is so clearly recognized, and so thoroughly understood by scientists, that any competent anatomist will undertake to tell at once from the skeleton of an animal, even though it be to him a new one, the exact nature of its diet in its natural state and the general structure of its digestive organs. Let us note some of the peculiarities of the different classes of animals in this regard.

Herbivorous Animals.

Herbivorous animals, which subsist upon grasses, twigs, leaves, and other coarse herbage, necessarily require a very capacious and very complicated digestive apparatus. Their teeth are formed for nipping and crushing the coarse herbage on which they feed. The bill of fare provided for them is indicated in Gen. 1:30: "And to every beast of the earth,

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1 "Shall We Slay to Eat?" by J. H. Kellogg, M. D. Good Health Publishing Company, Battle Creek, Michigan.

and to every fowl of the air, and to every thing that creepeth upon the earth wherein there is life, I have given every green herb for meat: and it was so."

Other animals, as the squirrel, monkey, and horse, also the cat, dog, lion, and other animals, which subsist upon grains, fruits, nuts, and the flesh of other animals, have a simpler digestive apparatus, consisting of a single stomach and a less complicated intestinal canal. The teeth also of these animals indicate the simpler character of their dietaries. The teeth of the squirrel, for example, are exactly adapted to cracking and picking from the broken shells the nuts and acorns upon which it naturally subsists. The teeth of the monkey, likewise, are precisely suited to its fare of nuts and fruits. The teeth of the so-called carnivorous animals, while in many respects different, still, to some extent, resemble those of the monkey and other fruit- and nut-eating animals. This fact, however, does not indicate that the monkey is by nature a flesh-eater, but rather that carnivorous animals, while not originally flesh eaters, have become such because of circumstances. This fact is strongly suggested by the eating habits of the squirrel, which subsists upon nuts when they are readily obtained, but does not hesitate to prey upon small birds in case of necessity. The common house rat, likewise, while closely allied to the squirrel, and fond of nuts, also eats meat when occasion offers; although its near relative, the water rat, is strictly vegetarian in its habits. We must not infer from this latter fact that the water rat is living beneath its privileges, but, rather, that the house rat has acquired a new and unnatural appetite for flesh. Dogs and cats thrive upon a diet of nuts, as do other animals generally classed as strictly carnivorous. The accompanying cut, for example, shows the picture of a wolf which belonged to

the author, and which, on coming into his possession, without the slightest demur made an immediate and complete change from a diet of raw flesh to a diet of nuts and cereals, consisting of crackers and protose. The animal seemed to be quite as fond of protose as of meat. Dogs and cats also take this purely vegetable product as readily as meat. The writer has often seen dogs cracking nuts with their teeth, and picking out the meat with great apparent relish.

The complicated stomach of the herbivorous animal is a wise provision which the Creator has made to enable it to make use of the great variety of foods which are included in its bill of fare. Every weed, every stem, every different shrub has characteristic properties of its own. The many thousands of plants which furnish food to this class of animals constitute a most extended and varied bill of fare. Fruits, nuts, and cereals, however, are comparatively simple and uniform in their dietetic properties, so that a simpler digestive apparatus meets the requirements. Those animals that subsist upon the flesh of other animals have also a practically uniform, simple dietary. In the world of living beings which inhabit the ocean the opposite is true. The vegetable forms are comparatively few and simple. Consequently those fish and water animals which subsist upon vegetables have very simple stomachs, while those animals which subsist upon other animals, as the different varieties of the whale family, have exceedingly complicated stomachs, some having as many as eight or nine stomachs wherewith to digest the different kinds of fishes and other water animals which enter their capacious maws. The existence of a complex stomach is then not necessarily an indication that the animal's diet must be vegetable in character, but rather that its dietary is complex, and requires a long and complicated digestive process. Grain-

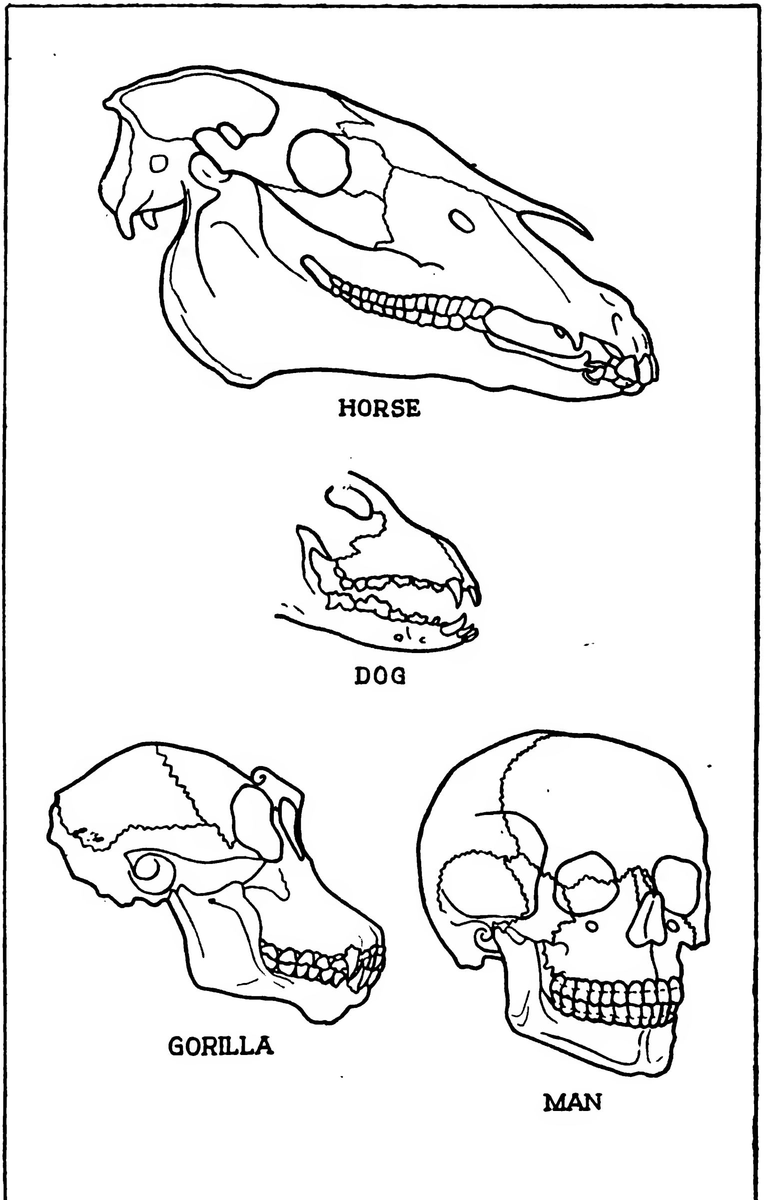
eating animals, as well as flesh-eating animals, have simple stomachs.

So-called Carnivorous Animals Not Originally Flesh Eaters.

It is hardly to be supposed that the flesh-eating animals were originally created to be destroyers of other animals. It seems more reasonable to regard them as animals which, while originally eaters of nuts and fruits, have by the failure of their natural food supply, been driven to the eating of other animals as their only means of sustenance. A dog can readily subsist upon a diet of nuts or even cooked cereals, but cannot subsist upon raw corn or other raw grains. In fact, according to the testimony of hunters and other keepers of hunting dogs from which the greatest feats of activity and endurance are required are only able to do their best when fed upon a strictly non-flesh dietary, consisting perhaps of corn-meal bread or similar food. Dogs thus fed have a keener scent and better wind than those which eat meat. If, then, an animal which in its natural state subsists largely, if not exclusively, upon a meat dietary becomes a more vigorous animal when fed upon a non-flesh diet, are we not led at once to the conclusion that carnivorous animals are such only as the result of an unnatural state of things, which has been brought about by the failure of their natural food supplies?

Various domestic animals have been known to adopt a diet of flesh when pressed by hunger. The cows of Nantucket, for example, in the winter time, when the grass is deeply buried beneath the heavy snows, are said to dig up with their hoofs the fish skins, which lie in great quantities along the shore, and to greedily devour them. Horses and goats have

A LITTLE CHILD SHALL LEAD THEM.



COMPARATIVE ANATOMY OF TEETH.

been taught to eat beefsteak with an apparent relish. There can be no doubt that a diet of flesh is more nearly adapted to the needs of grain-eating and nut-eating animals than is a dietary of grass and other coarse herbage.

The Bible and the traditions of profane history clearly picture the first representatives of our race as eaters of fruits, grains, and nuts, and also more than suggest that human beings were brought to the use of flesh food only through being deprived of their original and more natural food stuffs by famine.

Whatever may be true of the original and natural dietary of the so-called flesh-eating animals, there is no evidence whatever to show that man is by nature intended to use flesh. On the other hand, the exact resemblance of his teeth to those of the gorilla, the orang-outang, the chimpanzee, and others of the ape family which are strictly non-flesh-eating animals, place him in the same class. The teeth, for example, of man are precisely the same in number, kind, and arrangement as those of the gorilla. This may be seen by comparison of the accompanying cuts. The only noticeable difference is that the teeth of the gorilla are larger, and that the cuspid or so-called canine teeth, are longer than in man, and set a little apart from the other teeth, in which respect, however, the teeth of the gorilla resemble those of the dog; but the fact that the gorilla does not use his teeth for the purpose of killing other animals and the tearing of flesh is evidence that the existence of such teeth in the dog is not positive evidence that he is naturally a flesh-eating animal, or that teeth of this form are necessarily to be used in the eating of flesh. The gorilla finds excellent use for these so-called canine teeth in the eating of nuts and fruits, for which purpose they are quite as useful as in the tearing and eating of flesh.

The human tongue, which has so soft and smooth a surface, again places man with the non-flesh-eating class, and associates him with the ape, whose tongue exactly resembles that of man. In the possession of fingers and finger nails, man and the hairy apes are again associated. Herbivorous animals have hoofs, while carnivorous animals have claws. If man were intended to subsist on flesh, he should have been provided with claws with which to capture and tear his prey, as do the lion and other flesh-eating beasts.

The claim of some scientists that the first animals, including man, were all carnivorous, overlooks the fact that in order that a few animals should be carnivorous a large number of others must subsist upon the products of the earth. If all animals were carnivorous, the universal carnage which would result would soon lead to the extermination of animal life from the face of the earth. In order, for example, that the lion may have a sheep for dinner every day, there must be three hundred and sixty-five grass-fed sheep in preparation for his daily meals for one year, and the same for every year, reaching the enormous number of seven thousand three hundred sheep in the course of twenty years, should the lion live for that length of time. It is evident that in order that there should be a few carnivorous animals there must be a multitude of vegetable-eating animals, and this state of things must have existed as long as there have been carnivorous beasts. It is impossible, then, that all animals were originally carnivorous, and it is equally evident that from the beginning of time the vast majority of the members of the animal kingdom must necessarily have subsisted, as at the present day, upon the products of the earth.

Plants, the Food Producers.

It is evident, then, that animals cannot be the original source of food for animals in general, nor for any animals, except to a limited extent. When one animal subsists upon another, he is only taking vegetable food at second hand.

The fundamental difference between a plant and an animal is that the former has the ability, under the influence of light and the vital principle of organization, to store up energy by bringing together the inorganic elements of water, earth, and air into new combinations, known as organized substances, such as starch, fat, sugar, albumin, and cellulose, or wood; these substances — the products of vegetable growth — are magazines of energy.

Animals differ from vegetables in that they are unable to store energy by combining the original elements into organic forms. They must take the stores of energy which have been collected by plants, and through the aid of digestion and assimilation transform them into similar substances, which are in turn converted into heat and energy by the body.

The popular notion that lean meat is particularly valuable as a force-producer was long ago recognized as an error by physiologists. The inferiority of meat as a source of food is very clearly shown by the facts presented in the following table, based upon the most recent researches, which shows the number of food units, the measure of food value, in each pound of the substance named: —

	Food units in one pound.		*Food units in one pound.*
Beef	592	Chestnuts	1062
Potatoes	435	Walnuts	3242
Milk	347	Hazelnuts	3083
Corn	1648	Almonds (sweet)	3033
Rice	1596	Peanuts	2668
Peas	1515	Cocoanuts	2694
Bread	1083	Filberts	3265

By reference to this table it will be seen that lean meat really contains only about one fourth as many food units as cereals and nuts. In other words, the value of beef as a source of energy is only from one fifth to one fourth that of the best foods of purely vegetable origin.

But flesh is not only inferior to the products of the vegetable kingdom in the quantity or proportion of energy-producing elements which it contains, but it is also inferior in quality. The proteid, or albuminoid substances, of which flesh food is chiefly composed, are only useful in replenishing or repairing the proteid wastes of the body, which are comparatively small, and are decidedly inferior to vegetable fats in energy-producing value.

The popular idea that one must eat the flesh of animals, and especially lean meat, in order to have strong muscles, is a great error. The notion that one must eat a strong animal, an ox for example, in order to be strong, is a cannibalistic idea. The savage chief eats the rival chief whom he conquers, in the belief that he may become thereby possessed of his courage, not because he is particularly fond of his flesh. The man who eats beefsteak with the idea that he will thereby become possessed of the strength of the ox, is acting upon the same principle. Common sense would naturally lead one to suppose that if he wishes to eat for strength, he should profit by the example of the ox, and eat that which the ox eats, and thereby become strong. In other words, as the ox and the horse acquire strength from the use of corn, man may find strength in the same way. The ox has eaten the corn, and consumed the greater part of the energy eaten. There is still left in the tissues unused a portion of the energy derived from the corn which may be used as food; but it is very inferior food, for the reason

that along with the food elements furnished by the corn there are waste matters, substances which contaminate the food, and lessen its value. Muscles always contain more or less of fatigue poisons, which are the result of muscle work, as we have seen. The flesh of an animal which has been overheated or driven too hard, or which has been carried a long distance in a cattle car, or which has been chased by hunters in the woods, as in the case of the deer, is always saturated with these muscle poisons. When such flesh is eaten, the poisons are absorbed, and produce within the body the very same effect as similar poisons produced in the individual's body by the exercise of his own muscles. This accounts for the languor, lassitude, dullness, and often weakness, and even stupidity, experienced after a hearty meal of meat.

As has already been mentioned, hunters find their dogs less enduring when fed on meat than when fed on corn meal. The great production of heat renders them particularly sensitive to the poisons which are taken into the system with flesh food when given a meat diet. Four Chinese coolies, taking turns, two at a time, will carry a large man thirty or forty miles at the rate of five miles an hour, on a diet of rice and beans. Dr. Baelz reported an experiment which he tried when being carried in this way, which clearly shows the inferiority of flesh food to a simple vegetable dietary. His journey occupied several days. After the first day or two, it occurred to him that his carriers, whose sole diet was rice and beans, were insufficiently fed. He accordingly gave them a portion of meat in addition. After a day or two on the meat diet, they declined to take more of it, declaring that it made them tired, so that they could not do their work. The fleetest and most enduring animals are those which subsist

upon the products of the vegetable kingdom; as, for example, the gazelle, the reindeer, the hippopotamus, the ox, the horse, and the gorilla.

It is from the vegetable world — the coal and wood — that the energy is derived which runs our steam engines, pulls our trains, drives our steamships, and does the work of civilization. It is from the vegetable world that all animals, directly or indirectly, derive the energy which is manifested by animal life through muscular and mental work.

The Vegetable Stores, the Animal Uses, Energy.

The vegetable stores up energy; the animal expends energy. Vegetable albumen is stored food, while animal albumen is used food. Various wastes and poisonous products result from the manifestation of energy, whether by the locomotive or by the animal. The ashes, cinders, and smoke which result from the combustion in the locomotive, are represented in the animal by poisonous gases and various substances which escape through the lungs, skin, kidneys, and other excretory organs. There are also animal cinders represented in uric acid, a poison which produces rheumatism, calculi in various parts, hardening of the arteries, premature old age, apoplexy, and a variety of ailments. The flesh of a dead animal, no difference how healthy it may have been, contains a great quantity of these poisons, the elimination of which ceases at death, although their formation continues for some time after death.

When an animal is killed by cutting its throat or shooting it through the head, its entire body does not die instantly. It loses consciousness, its heart ceases to beat, its individual or somatic life ends, but its tissues still continue to live for several hours. During this time the activity of the living

tissue consumes the soluble food material which is in contact with the cells and tissues, and thus continues to produce the waste substances, which during life are rapidly removed from the body through the kidneys, lungs, and other excretory organs. When the heart ceases to beat, this cleansing process ceases, and the poisons, which are ever forming at a rapid rate, accumulate until the vital tissues are so saturated that every living structure is killed. So the flesh of a dead animal contains nothing but venous blood and poisonous juices, in addition to the organized tissues which have not yet been broken down.

Flesh Eating Tends to Degeneracy.

From these facts it is apparent that it is impossible for one animal to subsist upon another animal without increasing the amount of waste matters in its own tissues. As these wastes accumulate, the vitality and life of the animal must be smothered, just as the accumulation of ashes and smoke smothers the fire in a stove or furnace. It is thus apparent that the use of flesh must lead to the hastening of those degenerative processes which finally result in old age and death.

Flesh Eating Weakens the Defenses of the Body.

The body defends itself against germs by means of the germ-destroying activity of certain of its cells. The white blood corpuscles, by means of a property termed phagocytosis, are able to capture germs found in the blood, and destroy them. This property is also possessed to a high degree by the other cells found in various parts of the body. It is upon the activity of these cells that we especially depend for protection against the myriad of microbes which invade the alimentary canal. It has recently been determined, also, that

the blood serum possesses the power to destroy microbes in a very remarkable degree. This power of the serum of the blood to destroy germs apparently depends upon its alkalinity. Flesh eating diminishes the alkalinity of the blood, thus weakening this important defense of the body.

The poisons produced by microbes, and to a great extent those produced in the body itself, are destroyed by the liver. This poison-destroying property is, indeed, one of the chief functions of the liver.

The significance of these facts in relation to vegetarianism is apparent when we consider that the germ-destroying activity of cells and of the blood serum and the poison-destroying property of the liver are not unlimited. The blood cells and the blood serum can destroy a certain number of germs, but an indefinite number overwhelms them. It is unquestionably true that the juices of flesh, and also the poisons produced in flesh undergoing putrefaction, paralyze the white cells of the blood and other of the classes of cells upon which the defenses of the body depend, rendering them incapable of exercising their most essential function in the destruction of germs and germ poisons.

Paget, in his "Lessons on Clinical Surgery," asserts that the higher death rate from operations in cities (in England), as compared with rural districts, is due to the fact that inhabitants of cities live so largely upon meat.

Diseases Resulting from the Use of Flesh Foods.

The association and relationship existing between human beings and the so-called food animals, is such as to tend in the highest degree to the development of disease in both. Most domestic animals are subject to many of the diseases from which human beings suffer. The reverse is also true.

By means of the intimate association between man and the domestic animals, and the artificial conditions of life to which the poor brutes are exposed in fattening and otherwise preparing them for consumption as food, the best possible opportunity is offered for an interchange of maladies; that is, man communicates disease to the lower animals, and they in turn communicate to him either the same disease or others of equally grave character.

The diseases resulting from the use of flesh food may be divided into several classes: —

1. Those which are directly communicable,— parasitic diseases and diseases due to specific germs, such as tuberculosis and trichinæ.

2. Those which result from the use of decomposing flesh or fish.

3. Those which result from the use of the flesh of healthy animals.

Tapeworm.

There are many varieties of tapeworm, some of which inhabit the human body, others being found only in the bodies of lower animals. Of the few parasites to which human beings are subject, most are derived from the use of infected meat. This fact is so well known at the present time that it is not even necessary to quote authority for its support.

The tapeworm does not inhabit the stomach, but the small intestine, in which the creature sometimes grows to enormous length. The parasite is made up of short sections, each of which is provided with means for holding to the walls of the mucous membrane. Each section of the worm is continually throwing off eggs, which, finding their way through sewers into streams, are swallowed by cattle and other domestic

animals. In the bodies of some of these animals the young tapeworms develop active embryos, which work their way into the blood vessels, and are by this means distributed throughout the body. Reaching the muscles, they become established, and undergo further development. Beef or pork which contain these cysts, or tapeworm embryos, is said to be "measly." When measly flesh is eaten, the cyst wall is digested off by the gastric juice, and the embryo is set free; passing into the intestine, it fastens itself to the mucous membrane, where it commences rapid growth, and produces all the distressing and inconvenient symptoms arising from the presence of the parasite in the alimentary canal.

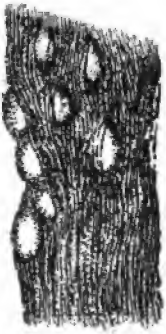
As pointed out by Dr. Leidy, the famous Philadelphia anatomist, the tapeworm is, in the great majority of cases, derived from the use of raw or underdone beef. In only about one tenth of the cases is the disease derived from pork.

Fish Subject to Tapeworm.

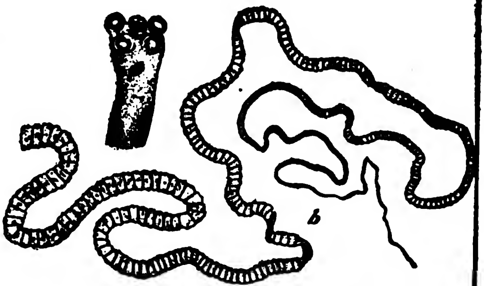
Some years ago the secretary of the Michigan State Board of Health received from a correspondent of the Board two fishes (bass) containing parasites of some sort. Accompanying the fishes was a request for an opinion as to whether or not they were dangerous to public health through parasitic infection. Professor Cook, of the Michigan Agricultural College, made an examination of the parasites, and reported as follows: —

"This is the cysticercus stage, or encysted form, of the tapeworm, probably the bothriocepalus latus, but we cannot tell from this stage. That is the broad tapeworm of man, and works in fish. Such fish should be well cooked." (Cooked tapeworm is a harmless diet!!)

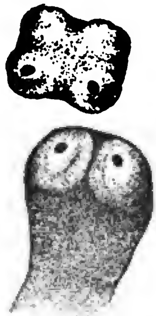
The popular idea that fish are safe from infection is thus



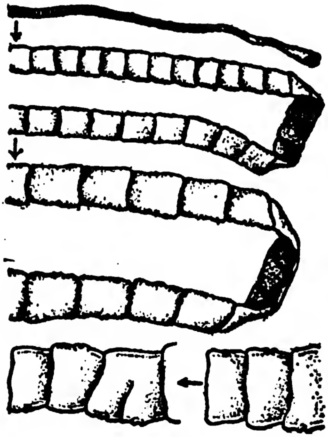
A PIECE OF MEAT INFECTED WITH PORK-MEASLES.



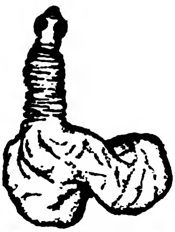
PORK TAPEWORM, HEAD HIGHLY MAGNIFIED.



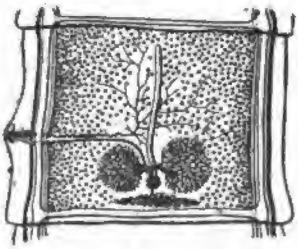
HEAD OF BEEF-MEASLE TAPEWORM.



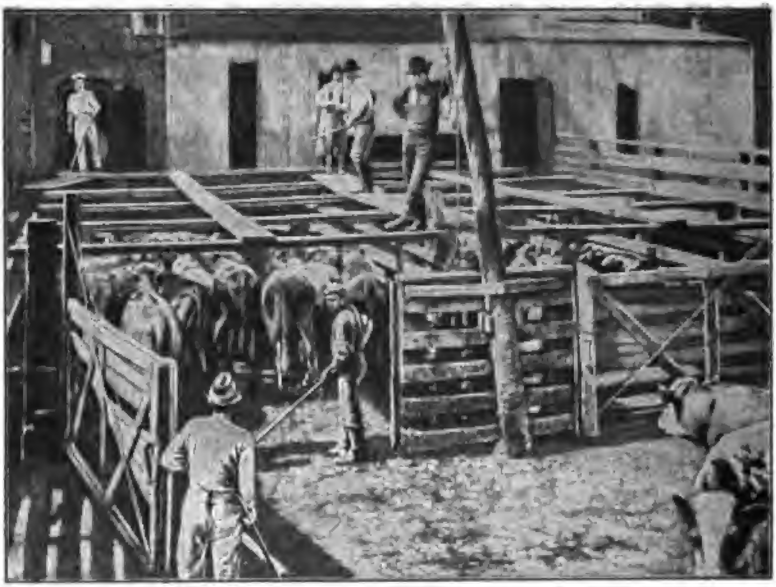
SEVERAL PORTIONS OF AN ADULT BEEF-MEASLE TAPEWORM.



PORK-MEASLE BLADDER WORM.



MATURE SEGMENT OF BEEF-MEASLES TAPEWORM.



A SCENE IN THE UNION STOCK YARDS, CHICAGO.

A SLAUGHTERING PEN.

shown to be false. As a matter of fact, fish are more exposed to infection than almost any other class of animals, especially those living in rivers receiving the sewage of towns and cities. The water of such streams invariably contains great numbers of eggs and living embryos of various parasites which infest the alimentary canal of human beings.

The existence of the embryonic or cystic stage of the tapeworm in fish is another evidence of the carnivorous nature of these animals. While all fish are not carnivorous, a large proportion of those employed as food by human beings are flesh-eaters. This is clearly evidenced by the nature of bait which is commonly used in catching fish. Who would think of going fishing with cherries, blueberries, or bits of apple, or potato as bait? From a physiological standpoint it would seem that one might as well eat a cat or dog as a fish. Indeed, the fact is not to be disguised that not a few of those whose appetites have been trained on fish have acquired a taste for the flesh of dogs, the meat of which, as well as that of cats, has more than once been used to give to some popular brand of sausage its particular characteristic and much esteemed flavor.

Tapeworm Infection among Dogs.

Dr. Salmon, chief of the Bureau of Animal Industry of the United States Agricultural Department, has recently called attention to another danger to which the people of this country are yearly becoming more exposed. The dog is subject to a peculiar species of tapeworm, the young of which are developed in the hog. This worm does not develop to a mature stage in human beings, but through the eating of offal and other fragments of infected flesh by dogs the number of infected dogs is constantly increasing, and the eggs produced

by these worms are, by the scattering of their excreta, widely dispersed. Human beings more and more are thus becoming infected, not with the tapeworm, but with the bladderworm, as the first stage of the parasite is termed. These bladders, or cysts, may be formed in the liver, the brain, the eye, or any other part of the body to which the very minute young parasite may be carried by the blood current.

The Deadly Trichinae.

This parasite, first discovered in the human body in a German dissection room about half a century ago, has become now so widespread and so well known that a description of it is scarcely necessary. It is more than probable that the majority of cases of trichinosis are never recognized as such. In its symptoms, the disease so closely resembles cerebro-spinal meningitis, muscular rheumatism, winter cholera, and other maladies that it is very likely to be overlooked.

The disease is almost universally contracted by the use of lean pork, most commonly in the form of ham and sausage, although within the last few years instances have been reported in which trichinæ have been found in fish and fowls. In its natural history the trichina somewhat resembles the tapeworm. In flesh infected with trichinæ, the parasites will be found inclosed in small cysts. The cyst walls are dissolved by the gastric juice when the flesh is eaten, and the parasite is thus set free. It soon develops numerous young parasites, and these quickly bore their way through into the blood vessels, in which they are swept along by the blood to the muscles. Here they lodge, becoming encysted in little capsules, where they may remain in a quiescent state for years, giving rise to no further inconvenience in some cases than rheumatic or neuralgic muscular pains. In severe cases, however, other

symptoms arise, such as purging and vomiting, set up by the irritation of the millions of parasites boring their way through the intestinal walls. During the migration of the parasites through the body, the patient suffers from fever, severe muscular pains, perhaps cramps or spasms, and other symptoms resembling rheumatism, spinal meningitis, and other maladies.

Those who console themselves with the idea that protection against these parasites is afforded by inspection, will not be at all comforted by the recent assertion of Dr. Salmon, of the United States Agricultural Department, that it is practically impossible to detect, even by microscopic inspection, all cases of trichinæ infection, for the reason that there may be no parasites in the tissue examined, while other portions of the body are swarming with them.

Tuberculosis from the Flesh of Animals.

According to a recent report by Dr. Salmon, tuberculosis is increasing at a remarkable rate in this country among cattle and swine. It is known that two or three out of every hundred cows are infected, and in some districts twenty-five and even fifty per cent of the cows are suffering from this germ disease. Professor Koch has undertaken to show that such flesh is not dangerous; but very few scientists agree with him, and various experiments which have been made since his announcement of this idea have proved very conclusively that the disease is communicable to human beings. A nurse inoculated with the germs obtained from a cow infected with tuberculosis, has been taken to a hospital, suffering with consumption. Three men in Berlin who were inoculated with material obtained from a tuberculous cow, have also shown signs of the disease. A butcher inoculated his thumb while cutting

the flesh of a tuberculous animal, and contracted the disease. Numerous similar instances have been brought forward.

It is hence clear that Professor Koch is mistaken, and that the flesh of tuberculous animals must be condemned as absolutely unfit for use as food. The weekly report of the officials in charge shows that many tons of such flesh are condemned every week in the Union Stock Yards in Chicago. Doubtless many times the quantity condemned, in which the disease is still in an incipient stage, escape the observation of the inspectors.

Typhoid from Oysters.

There is no direct evidence that typhoid fever can be contracted by the use of the flesh of warm-blooded animals, but it has been for some years perfectly well known that the oyster is a frequent means of communicating this disease. Numerous epidemics of typhoid fever in France, England, and the United States have been traced to the use of oysters.

Hog Cholera from Lard.

A disease closely resembling the malady known as hog cholera in swine has been observed in human beings, as the result of the use of lard obtained from the bodies of hogs that have been killed while suffering from this disease. Such a case was reported a few years ago to the Michigan State Board of Health, and the examination of the lard showed the germs of hog cholera to be present in great numbers. It is noticeable that whenever this disease breaks out in a community, great numbers of hogs are immediately hurried off to the nearest live-stock market.

More than thirty thousand hogs are annually condemned at the great packing establishments where inspection is main-

tained because of the presence of hog cholera, and yet an eminent authority bears testimony to the fact that those condemned are few in proportion to those found suffering from the disease, as only those are condemned in which the evidence of the disease is very extensive, slighter cases being passed after removal of those organs which give distinct evidence of the presence of the germs characteristic of the disease.

It appears that a large proportion of flesh food eaten must be more or less tainted with disease. Indeed, a Chicago official stated a few years ago that if all the diseased meat were condemned, the price of meat in Chicago would be one dollar per pound. It must be considered, then, that one dollar a pound is the proper price for beef. The Beef Trust should not be condemned for the high price of meat, but should be encouraged to make the price higher, on condition that only healthy meats should be furnished.

Hogs and other animals are subject to numerous other inflammatory and infectious diseases, which give rise to poisonous substances the presence of which in the tissues must render them entirely unfit for food, and subject to disease conditions which are none the less dangerous because so obscure that their real origin is in many cases never traced. To the presence of such poisons may doubtless be fairly attributed many of those sudden outbreaks of sickness which follow the use of canned meats and other meat preparations, such as that which recently occurred in a Western military barracks when eighty soldiers, strong, hearty men, were all made exceedingly sick, many barely escaping with their lives, immediately after partaking of a flesh meal. Who ever heard of such results following the use of bread, potatoes, or any other vegetable food, unless there had been accidental or intentional addition of poisons of some sort?

The rapid decay of teeth among civilized nations is both a consequence and a cause of the race deterioration that is at present going on with such rapidity, and is an evidence of the constitutional failure that lies at the bottom of all structural degeneration. That flesh eating is a most active cause of decay of the teeth no one at all acquainted with the facts will deny. The fibers of lean flesh retained between the teeth undergo decay, harboring and encouraging the development of the germs that produce decay of the teeth.

Thus it is seen that flesh food begins its mischievous work as soon as it enters the alimentary canal. In the mouth the teeth are destroyed. In the stomach and the intestines poisons are formed, which are absorbed into the blood, and which set up morbid processes of a most destructive character in all parts of the body.

A German chemist pointed out years ago that decomposition, or decay, in animal substances is always accompanied by the production of deadly poisons. These are generally known as ptomains and toxins. There are many of them so subtile in character that a very minute quantity will produce poisonous effects. Certain savage tribes poison their arrows by striking the points into the bodies of decomposing animals. It is to these poisons that are due so-called dissection wounds, which sometimes prove fatal to medical students and physicians. Butchers not infrequently suffer from wounds of the same nature, as the result of cutting themselves with knives that have been used in cutting meat.

The common practice of keeping flesh until it is tender is simply waiting for decomposition to advance to such a stage that the muscular tissues have lost their natural tenacity; in other words, until they are softened by the process of decay. The proprietor of a cold storage establishment of Chicago

told the writer that he was personally knowing to the fact that a poultry dealer once kept in his establishment several thousand ducks for a period of more than two years. It is a common practice in many districts for fowl intended for the table to be hung up by the head out of doors in the sun until by decomposition the tissues are so softened that the body detaches itself from the head, and falls to the ground. "Prime beef" sold in the markets is always far advanced in decomposition, and also a large share of the game which is exposed for sale, as is evidenced by the putrescent appearance and odor of the partridges, rabbits, and other species of game constantly seen on sale in the city markets.

Canned meats are undoubtedly the most common of all sources of meat poisoning. It is perhaps not generally known that canned meats decompose with very great rapidity, and develop deadly poisons, often within a few hours after the can is opened, so that deadly effects may be produced by eating of the contents of a can opened and partially consumed at a previous meal. Numerous cases of this sort have been reported. The only certain safety from this source of disease and death is in the total disuse of flesh foods, especially since it is now well understood that in certain forms of decomposition that take place in flesh, nonodorous substances are formed that are most deadly poisons, so that neither smell nor taste can give warning of the existing danger.

The accumulation of waste substances within the body, as the result of idleness or excessive feeding, is a most prolific source of disease. When the flesh or tissues of another animal, with their poisons and waste matters, is taken into the body, precisely the same effect is produced as that resulting from deficient exercise; hence the combination of sedentary habits with a flesh diet is highly productive of disease.

Meat Eating a Cause of Gout and Bright's Disease.

English gout, formerly attributed to the free use of wine, is now well known to be due to English roast beef. The blood becomes so saturated with the waste substances derived from the flesh of dead animals, in addition to those generated within the body, that uric acid and allied substances, representing the excrementitious elements, are deposited in the vicinity of the joints, giving rise to gout.

Dr. Haig, an eminent English medical authority, asserts that "Bright's disease is the result of our meat-eating and tea-drinking habits, and as these habits are common, so also is the disease, and much more common, I believe, than available statistics at all serve to demonstrate."

Flesh Eating and Cancer.

Verneuil, of Paris, and Roux, of Lausanne, have recently announced the startling theory that the use of pork is the cause of cancer. M. Verneuil some time ago stated that his observations had convinced him that the use of meat as a regular diet was the most probable cause of cancer, and the further study of the subject has led him to the conclusion that pork, if not the sole cause of cancer, is at least a very common factor in the etiology of this disease.

An eminent New York surgeon recently asserted that if cancer should increase in the city of New York during the next ten years as rapidly as it has during the last ten years, it would come to be the most deadly of all maladies. It is now pretty generally recognized that cancer is a parasitic disease. Meat eating, and the use of meat preparations, evidently lessens the resisting power of the body against this parasite, a small animal organism, and thus prepares the way for its invasion of the body.

Flesh Diet and Epilepsy.

A few years ago, an eminent physician, the chief of staff of one of the largest insane asylums in the United States, called the author's attention to the profound influence of a flesh dietary upon epileptics. This fact had been partially recognized by the medical profession previously, but the doctor's experience shows conclusively that flesh food has the most pernicious influence, not only in aggravating the conditions present in epilepsy, but in causing this disease. It is especially interesting to note in this connection that cats fed meat are very subject to epileptic attacks.

Haig has called attention to the fact that epileptic attacks are due to an increase of uric acid in the blood, whereby the circulation in the brain is interfered with. He, as well as others of equal experience, has found that the avoidance of flesh foods, together with tea, coffee, cocoa, and similar beverages containing poisonous elements similar to those found in meat, is one of the most effective means of controlling epilepsy.

The fact that the gastric juice is deficient in free acid is the reason usually given for withholding flesh food during fever. This reason is certainly a good and sufficient one Hydrochloric acid is absolutely necessary, not only for the digestion of flesh food, but for its disinfection. As eaten, flesh food is always in a state of more or less advanced putrescence. But there are conditions in which free hydrochloric acid is often absent. In hypopepsia, one of the most common forms of dyspepsia, free hydrochloric acid is either absent or is present in such small amount that its disinfecting and digestive powers are certainly insufficient to cope with decomposing flesh. In chronic catarrh of the stomach, in dilatation and prolapse of the stomach, and in many other conditions that are exceedingly common among dyspeptics, there is the same inability

to deal with a food substance like meat irrespective of the poisons that it contains. Thus vast multitudes of persons are daily swallowing quantities of flesh food which they cannot possibly digest, and which necessarily decays in the stomach and colon, and invites and aggravates disease.

The Ethics of Flesh-Eating.

The basis for the ethical argument against flesh eating is to be found in the fact that lower animals are, in common with man, sentient creatures. We have somehow become accustomed to think of our inferior brethren, the members of the lower orders of the animal kingdom, as things; we treat them as sticks or stones, as trees and other nonsentient things that are not possessed of organs of sense and feeling. We are wrong in this; they are not things, but *beings.* We forget the wonderful likeness that exists between us and the lower creatures. We neglect the fact that their brains are like our brains, their muscles like our muscles, their bones like our bones; that they digest as we digest; that they have hearts that beat as ours beat, nerves that thrill as ours thrill; that they possess to a wonderful degree the same capacities, the same appetites, and are subject to the same impulses as we. An ox, a sheep, can hear, see, feel, smell, taste, and even think, if not as well as man, at least to some degree after the same fashion. The lamb gamboling in the pastures enjoys life much the same as the little child chasing butterflies across the meadow. A horse or a cow can learn, remember, love, hate, mourn, rejoice, and suffer, as human beings do. Its sphere of life is certainly not so great as man's, but life is not the less real and not the less precious to it; and the fact that the quadruped has little is not a good and sufficient rea-

son why the biped, who has much, should deprive his brother of the little that he hath. For the most part it must be said that the lower animals have adhered far more closely to the divine order established for them than has man.

The divine order, as clearly shown by nature as well as by revelation, and by the traditions of the ancient world, and illustrated by the present practice of a great part of the human race, makes the vegetable world the means of gathering and storing energy, and making it into forms usable by the sentient beings that compose the animal world, the one gathering and storing in order that the other may expend. When animal eats vegetable, there is no pain, no sorrow, no sadness, no robbery, no deprivation of happiness. No eyes forever shut to the sunlight they were made to see, no ears closed to the sweet melodies they were made to hear, no simple delights denied to the beings that God made to enjoy life,— the same life that he gave to his human children.

A lady artist once remarked to a friend, "How can you eat a thing that looks out of eyes?" The gentleman declared that from that moment whenever he sat down to a table where mutton was served, he saw a pair of gentle sheep's eyes peering at him, and was unable to touch his meat. Eyes imply a mind, an intelligence, something that has feeling and capacity for enjoyment, and that looks out upon the world, forms its opinions, its likes, its dislikes, enjoys, suffers, loves, *hates,*— experiences in which *all* creatures belonging to the animal kingdom are one. So there is, in a certain sense, not only a universal brotherhood of man,— although few recognize even this fact,— but there is likewise a greater brotherhood, which includes not only man, civilized man, savage man, Christian man, heathen man,— all men,— but likewise man's

humble relatives of the animal world, into whose nostrils as well as into man's God breathed the breath of life.

Man rears his cattle, his sheep, and his poultry much like household pets. His children make his lambs their playmates. Side by side his oxen toil with him in the field. In return for kindness, they give affection. What confidence they repose in him! how faithfully they serve! With winter's frost an evil day arrives,— a day of massacre, of perfidy, of bloodshed and butchery. With knife and ax he turns upon his trusted friends, the sheep that kissed his hand, the ox that plowed his field. The air is filled with shrieks and moans, with cries of terror and despair; the soil is wet with warm blood, and strewn with corpses.

The fact that our so-called Christian nations are behind many heathen nations in the estimation they put upon life as manifested in animals below man in the scale of being, is without doubt one of the greatest obstacles that has stood in the way of the advancement of Christianity in China, Japan, India, Burma, and kindred countries.

Let me ask you to peep into one of the great abattoirs of a large city. Unless you have already been accustomed to spectacles of gore such as are afforded by the town slaughter-house, or "butchering day" on the farm, you may perhaps be too shocked to proceed before you have completed the tour of one of these stupendous slaughter-pens.

In the Union Stockyards of Chicago enormous wealth has constructed a machine for killing, the most expensive to be found in the world. As the *Cosmopolitan* says, "It is a region of order and death, but a sight that will stir the most casual onlooker or the deepest philosopher." And it does stir — it changes every man who lives in contact with it.

Let us look at some of these pictures and let each one of us note how he is "stirred." The man whose soul is not so calloused that he has ceased to think humanely, and has lost sight of the great fatherhood of God, and the great kinship of all living, sentient things, must be stirred to feel that the slaughterhouse, whether it be the wretched shanty just outside the limits of some country village, or the enormous structure filled with ingenious machinery of every description managed by a great packing company, is simply a place where organized killing — premeditated, systematic taking of life — is carried on.

We should doubtless regard these gigantic cruelties as closely akin to murder had we not been long accustomed to look upon animals as mere things, like blocks and stones, rather than creatures in whose veins runs blood like our own, whose nerves thrill with sensations akin to those which we experience, who exhibit much the same traits as do human beings,— love, hate, envy, courage, timidity, forethought,— which plan and execute, which combine with others against a common foe, and loyally defend, even to the death, a friend or kin.

The accompanying cut presents a small section of the cattle pens in which the poor brutes are confined "in blissful ignorance of their fate." Here, we are told, there are often to be found from "forty to fifty thousand hogs, twenty thousand cattle, and five thousand sheep." Two hundred acres of yards are densely crowded with unoffending brutes, waiting to be slaughtered. As the writer of the articles referred to tells us, "hardly any sunrise sees in existence any part of all this life that on the previous morning bleated, squealed, and bellowed under the urging whip of the drover." Think of it! More than one hundred and fifty thousand lives snuffed

out in one day! In 1897 nearly four million cattle passed through these yards to death, and more than eight million hogs, to say nothing of the vast numbers of sheep and calves.

The illustration shows one of the yards into which the cattle are driven in small lots when they are to be slaughtered, and from which they are crowded into a long alley. The alley is divided into compartments, into which the poor brutes are crowded two by two, and so closely hemmed in that they cannot stir.

Confused, dazed by their new surroundings, frightened by the drover's whip, possibly imagining that they are being parceled off to be fed, they meekly stand, waiting they know not what. Presently an assassin, unseen, unexpected, slips up behind, and deals each poor brute a sledge-hammer blow between the eyes, which fells him to the floor, not dead, but insensible.

One of the big doors shown in the picture now rises, and the innocent victims are rolled out upon the floor. At this point they are seized, swung aloft, flayed, eviscerated, drawn, quartered, and hung up to "ripen" by processes of putrefaction until they become "Christmas beef," possessing just the right odor and flavor of putrescence to suit the appetite of the epicure, tender morsels to be torn into shreds by dainty teeth that are carefully cleansed and polished three times a day only to be as many times plunged anew into the decaying carcass of some dead beast.

Consider a moment, reader, how much blood is poured out in this slaughter. A calculation based upon very moderate figures shows that the amount of blood annually shed in the Chicago abattoirs alone is more than sufficient to float five great ocean steamships. What crime have these poor brutes committed that they should thus be executed? What law of

God or man have they violated that they should thus prematurely die, that their blood should be poured out upon the soil as a fertilizer? Verily, the blood of multimillions of innocents cries from the ground.

The influence of the abattoir, of the common slaughterhouse, is equally shown in the moral deterioration evident in the men whose lives are devoted to the slaughtering of innocent beasts. The ears of such men become deaf to the agonizing cry of the intelligent brute that suspects its fate. The spectacle of a living being pouring out its life-blood in a gushing stream, loses its ghastliness; the sight of quivering flesh, of writhing entrails, loses its gruesomeness; life, that divine spark of infinite energy which animates all living things, and makes all sentient creatures kin,—this wonderful, mysterious, God-given life,—loses its sacredness. The hired assassin is almost always a butcher. The perpetrators of many of the most atrocious and cold-blooded crimes have been more frequently butchers than men of any other occupation. That a man is by trade a murderer of brutes — a butcher — is almost universally, in Christendom, regarded as a disqualification for service upon a jury in which the question of responsibility for human life is involved.

Red blood is a mark of kinship which as human beings we must recognize. The Bible declares the unity of animal life. "The Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life." Gen. 2:7. "And they went in unto Noah into the ark, two and two of all flesh, wherein is the breath of life." Gen. 7:15. There is a fraternity more comprehensive and more universal than the "brotherhood of man." Let us think and speak of the "brotherhood of being." Let us see in the ox a patient, industrious kinsman, worthy of respect. Let us see and recognize

in the sheep a meek and docile fellow creature appealing to us for protection and admiration.

BIBLICAL FLESH EATING.

Does the Bible forbid the use of flesh food? In answer to this oft-repeated question, we must frankly say that we cannot affirm that flesh-eating is explicitly forbidden by any Bible command. The same, however, might be said in relation to other unwholesome practices, the evil character of which no one disputes. In what we have to say from a Biblical standpoint, we have no hope of convincing those who, when convicted of physiological faults, seek shelter behind the fact that there is no express Bible command to the contrary, and maintain the right to transgress the most clearly defined laws of health so long as they can find a seeming apology for so doing based upon ancient usage, or the absence of any Biblical precept directly forbidding the same. Such persons make no attempt to answer the scientific argument or to controvert the evidence of science and experience. If only a passage of Scripture can be quoted which may possibly be so construed as to support the favorite sin, these persons are content. The minds of these individuals seem not in the least disturbed by the fact that their mode of argument, and their interpretation or use of Scripture, arrays God against himself, for the revelation of God in nature is as truly divine as is the revelation of God in the inspired Word. "For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made." Rom. 1:20. The intelligent Christian, who regards as of equal authority the divine laws written in our bodies, and revealed in its varied functions, and the teachings of the inspired Word, will hold his mind in a wholly different attitude. If we find an apparent

contradiction between the teaching of science and experience and the Biblical teaching, we should not deny the authority of either, but should seek to find a basis for harmonizing the same; for all truths will be found to agree, when correctly understood.

The disposition to seek a theological apology for a physiological sin is well illustrated by the arguments often produced in support of the practice of flesh eating. It is useless to present to those who reason in this way the fact that the killing of animals is ethically wrong, since the animal has a right to live, and man has primarily no right to destroy the life which he did not give and cannot restore; that the flesh eater not only invades the rights of animals, but injures himself through the diseases which he contracts; that he shortens his life, impairs his mental and moral faculties, and brings upon himself many unnecessary miseries. Make these and many other facts never so clear to them, and still, with the utmost complacency, and with an air and expression which indicate the belief that the last word has been said upon the subject, they reply, "Did not God give Noah permission to eat meat? Did not the Jews eat meat with their sacrifices? Did not Christ eat meat, and did not Abraham's angelic guests also partake of flesh? And did not the Lord say to Peter when there was let down before him a sheet containing animals of all sorts and creeping things, 'Arise, slay and eat'?"

It is not our object to undertake to answer all the quibbles which may be raised by persons whose purpose is to defend their pet foibles at all hazard, but merely to present a few principles which have an important bearing upon this question, leaving the reader to settle the matter of his individual diet with his own conscience, believing that those who are really earnestly seeking for truth will have no difficulty in

deciding what is truth through the leading of that Spirit of Truth which is ever ready to guide into all truth the honest seeker after light and knowledge.

The Original Bill of Fare.

To begin with, let us note the fundamental fact recorded in the first chapter of Genesis: "And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat. And to every beast of the earth, and to every fowl of the air, and to everything that creepeth upon the earth, wherein there is life, I have given every green herb for meat." Gen. 1:29, 30.

Here the fact is plainly stated that God gave to man for food the seeds of herbs; that is, cereals and legumes, or wheat, corn, oats, barley, rye, peas, beans, lentils, and similar products, and in addition, the fruits of trees, which comprise not only the vegetable products commonly called fruits, but also nuts. Hence the dietary which God gave the first man, and through him to the whole human family, consisted of fruits and seeds. When God placed man in the earth, he informed him respecting the food which was especially adapted to his constitution and needs, and for the digestion of which his digestive organs were especially fitted. Certainly no one could be better acquainted with man's needs than his Creator. The bill of fare given Adam has never been withdrawn, and must be as well adapted to Adam to-day as six thousand years ago.

The First Permission to Eat Flesh.

But what about the permission given to Noah after the flood? First, let us inquire, Is it likely that the constitution of the human race was so changed during the short time Noah

was confined in the ark that Adam, after the flood, required a flesh diet, which was not suited to Adam before the flood? Such a proposition is hardly possible. Did God make a mistake in prescribing a diet of fruits, grains, and nuts to Adam in the first place? Did the Almighty ascertain by man's experience that a mistake had been made in arranging his bill of fare?

A careful consideration of the text in the ninth chapter of Genesis, in which permission to eat flesh is granted, will show us very clearly and unmistakably that such questions need not be raised. The several points presented in the first five verses of this chapter may be placed in the following logical order: —

1. Man is given permission to eat flesh; "Every moving thing that liveth shall be meat for you."

2. He is given permission to eat grass and green herbs of all sorts.

3. The use of blood is forbidden, an important restriction: "But flesh with the life thereof, which is the blood thereof, shall ye not eat."

4. Warning is given: "And the fear of you and the dread of you shall be upon every beast of the earth."

5. A punishment is threatened: "And surely your blood of your lives will I require; at the hand of every beast will I require it." A literal translation of the original justifies the following rendering: "And truly your blood of your lives will I *seek;* by the hand of every beast will I *seek* it."

The Permission to Eat Flesh Carefully Restricted.

Certainly no very strong recommendation for flesh eating can be found in the foregoing permission. The simple fact that so far as the instruction given to Adam might be consid-

ered a command to abstain from eating other foods than fruits, grains, and nuts, this restriction is removed, and man is given permission to eat "every moving thing that liveth," the "green herb," and, in fact, "all things." Verse 3. But at the same time he is warned that if he takes the life of animals, they will be afraid of him, they will flee from his presence; and not only that, but they will in turn, in retribution, seek to take his life, to shed his blood. Surely there was nothing in this calculated to greatly encourage Noah to add flesh to his bill of fare.

We may profitably consider briefly the important restriction made respecting the use of flesh,—"The blood thereof shall ye not eat." All flesh contains blood, but this blood must not be eaten, for it is the life of the flesh.

The command to abstain from blood, that is, to remove it thoroughly before eating the flesh, is thus clearly shown, and applies to the whole human family since the flood, or to every person who has ever had permission to eat flesh.

According to Jewish writers, the old Jews carefully separated the blood from the flesh by covering the flesh with salt and afterward washing it thoroughly. The orthodox Jews do the same to this day. Whether or not the cleansing was ever done with the scrupulous care which the command of God requires, does not matter. The Bible injunction is plain, —the blood must not be eaten, for it is the life of the animal.

The Life Is in the Blood.

There is a wonderful divine mystery in the blood. It carries life into every part to which it flows. It is the vehicle through which the creating, maintaining, and healing power manifested in the body is carried on. God

works in the blood in building, rebuilding, nourishing, and healing the bodies of both man and animals. This fact must ever be kept before the mind. If man finds it necessary to eat the flesh of animals, he must recognize that he is taking life in so doing, and he must do it only under circumstances of dire necessity, when his own life will perish unless the life of an inferior creature is sacrificed in his behalf. The life of an animal must not be taken ruthlessly, but with reverence for the Creator and with respect for the rights of the animal.

Flesh Permitted as an Emergency Diet.

It thus appears at least probable that the permission to eat flesh was only to provide against special occasions of scarcity, famine, drought, and failure of the usual supply of natural food.

The world was cursed; the favorable conditions existing in Eden had disappeared; the flood had devastated great portions of the earth's surface, washing away the soil, leaving bare the sterile rocks, and covering great areas with sand; the climate of the earth was changed, and man was in consequence exposed to conditions which must necessarily involve risk of want and scarcity, and even the entire absence of the substances which composed his natural bill of fare. He is instructed that under these circumstances he may eke out his existence by sharing with the ox his bill of fare of herbs, and in case of direst necessity he may even eat the ox himself, but only on condition that he remove from the dead flesh of the animal every particle of the blood which it contains.

May Christians Eat Fish?

But how about fish? Fish, as commonly eaten, are altogether prohibited by the Bible injunction, for all fish caught in the ordinary way die of strangulation, and all the blood

of the animal is left in the body; hence no Christian can eat fish as sold in the markets without violating a distinct Biblical injunction. See Leviticus 17.

The Jews, and some modern fishing tribes, drain the fish of blood after taking from the water, by making a deep incision.

Physiological Objections to the Eating of Blood.

That the Biblical restriction respecting the use of blood is not an arbitrary one, is clear enough to any one familiar with physiological facts. The blood contains the soluble wastes of the body; the tissues consist of the insoluble living parts. The blood is the vehicle of both life and death to the tissues. It flows to each organ of the body, a living stream. It flows out, freighted with the elements of death, with poisonous substances which, if retained in the body for any length of time, must cause disease and death.

The rapidity with which the blood becomes impure and poisonous may be easily noted by observing how readily the lips become blue when the breath is held, and the blue color quickly assumed by a finger when strangled by winding a string about it.

While the Bible certainly permits the use of flesh as food, those who appeal to it in defense of the practice will do well to think of these things, and to study carefully foundation principles instead of relying upon incidental references.

Some things were permitted to the ancient Jews because of the hardness of their hearts.

The Natural Way in Diet.

IT is to be hoped that the reader who has carefully studied the foregoing pages of this volume will have fully satisfied himself respecting the character of the food which may properly be eaten for the nourishment of his God-given body, and that he is able to make a wise selection of food substances suited to his individual needs. Several very important questions remain, however, to be considered in relation to the manner of eating and the quantity of food to be taken, the frequency of meals, preparation of food, the question of variety at meals, fasting, and other questions of equal importance. We will now undertake to consider each of these questions in a brief and careful manner: —

Hygienic Cookery.

The very best food may be spoiled in the preparation. The aim of cookery should be to increase the digestibility of food, as well as to render it inviting to the eye and to the palate. Cooking should be regarded as a sort of preliminary digestion for those food stuffs which are not by nature prepared to immediately enter the digestive apparatus. Cookery is especially required for the preparation of cereals and vegetables. Nuts and fruits are also in many instances improved by cooking, although their natural adaptation to the human digestive processes, and the absence of raw starch in fruits and nuts, renders cooking less essential in their preparation.

Thoroughly hygienic cookery excludes from the kitchen grease in all forms, vinegar, baking powder, mustard, pepper,

and other irritating condiments, and of course finds no use for the conventional frying pan, meat broilers, and similar mischief-making contrivances.

Why Fats Render Food Indigestible.

Let us notice some of the reasons why these articles must be excluded. Grease, whether in the form of lard, tallow, butter, cottonseed oil, olive oil, ko-nut, or other pure, separated fats, is not needed, for the reason that it cannot be mixed with the food without impairing its digestibility and thus lessening its value. Nature provides fats in a state of emulsion, that is, in a condition of division into minute particles, which, when taken into the stomach, mingle readily with the digestive fluids and other food elements without interfering with the digestive process, and when passed on into the small intestines are quickly absorbed into the circulation, and utilized. It is in this form that fats are found in nuts, nut butter, and other nut preparations, and in cream and milk. In the form of butter, lard, tallow, and other fats the minute particles have been made to adhere together in a homogenous mass. When these fats are taken into the stomach, they merely float upon the digesting mass, smear the walls of the stomach, surround the particles, and to a considerable degree interfere with the process of gastric digestion, since the gastric juice has no effect whatever on fat. These substances cannot undergo digestion until passed on into the small intestines, where they are brought in contact with the pancreatic juice and the bile; but being detained in the stomach, and interfering with the digestion of other food substances, they promote fermentation and indigestion, giving rise to heart-burn, biliousness, and other disorders.

Recent observations show also that the presence of fatty substances in the stomach in considerable amounts prevents the secretion of the acid needed for the proper action of the gastric juice upon the albumins of the food. Fats are necessary, but they should be taken in a state of emulsion.

This prevents interference with digestion; but when fat in the form of oil, lard, butter, etc., is added to the food, it smears over the particles of proteid, gluten, albumin, etc., so that the gastric juice cannot get access to them to digest them. The gastric juice cannot act upon fats.

In the same way, fat interferes with the digestion of starch, saturating the particles of starch so that the saliva cannot act upon them to convert them into sugar. This is the principal reason why, in many cases, fats and fat foods are so apt to produce fermentation, sour stomach, heart-burn, and other symptoms of indigestion.

Objectionable Vegetable Fats.

We are often asked the question, "Are nut oils, olive oil, cottonseed oil, and similar fats derived from vegetable sources to be considered altogether wholesome?" To this question we must say no. The chief objection to the use of oil, lard, tallow, butter, and other forms of "grease" is that they present the fat in an artificially concentrated form, in which it does not harmonize with the other elements of food while undergoing digestion in the stomach.

It may be mentioned, also, that many of the nut oils and butters are made from unwholesome materials. Some cocoanut preparations, for example, are made from rancid cocoanut oils by a chemical process. Such preparations cannot be commended.

In nature, the fat is separated or held apart in minute particles, or drops, and these are arranged within the proteid masses in such a way that they cannot be set free until after the proteid, or albumin, is digested.

Pure fats are very disturbing to the stomach in some forms of gastric disorder, especially in gastric catarrh and dilatation of the stomach. The cooking of fats in connection with cereals and albumins greatly aggravates the difficulty, for the reason that the fluid fat penetrates the starch granules, thereby rendering their digestion impossible, even after coming in contact with the digestive fluids. This is the reason why fried foods, griddle cakes, doughnuts, pastry, roasted peanuts, and even nut butter made from roasted peanuts, disagree with so many persons.

Natural fats are in a state of emulsion, as in cream. An emulsion may be diluted with water to an unlimited extent, as the oil is in minute particles, which are prevented from uniting by the thin film which surrounds each globule. Cream can be taken by many persons with whom butter disagrees, but with persons whose stomachs are dilated, cream and milk often produce effects which in their intensity are almost equivalent to those of an active poison, producing biliousness, sick headache, and other distressing symptoms.

In nuts, fats are presented in an emulsified state. Cream and milk made from nuts are entirely wholesome, and agree with persons who cannot take cow's milk and cream without very harmful results on account of inability to digest casein.

The ripe olive is another wholesome source of fat which is worth considering. The olives must be thoroughly ripe, and before eating should be soaked long enough to extract the salt which they contain.

There are now supplied ready for use a variety of nut fats which are exceedingly wholesome and palatable, and are perfect substitutes for all kinds of animal fats and oils. Nut butter made from peanuts which have been cooked but not roasted, almond butter, cocoanut cream, nuttolene, nut meals, and various other nut foods, are good sources of fat.

Chemical Bread Raisers.

Baking powder, and of course soda, saleratus, and tartaric acid commonly employed with these alkalies, although almost universally used as a quick and convenient method of making toothsome breads and other cereal preparations, must be altogether condemned as unfit to enter the human stomach. These chemical substances form in the stomach a chemical compound well known under the name of Rochelle salts.

Though the daily use of these drugs may be small, their continued use, day after day, for months and years, not only interferes with the action of the gastric juice, but finally destroys the power of the stomach to make this very necessary digestive fluid, and thus becomes a potent source of indigestion and all the terrible consequences which follow this condition when long maintained. Most baking powders contain alum and other substances which are still more injurious. Bread made with these powders and fed to a dog produced inflammation of the stomach. The mischief done by these chemical substances does not stop at the stomach; both the liver and the kidneys suffer from their presence, and the great mischief done by them is widespread throughout the body.

Mischiefs Arising from the Uses of Vinegar.

Vinegar is another chemical substance which hygienic cookery must discard from the kitchen and the table. A per-

fect substitute for the agreeable acid flavor of vinegar is provided in lemons and other acid fruits. When lemons are not available, a supply of acid grape juice may be laid in store by canning a quantity of green acid grapes. Cranberries, gooseberries, and currants also afford agreeable and entirely wholesome acid flavors that may well replace the unwholesome acetic acid of vinegar. Recent studies on the subject by eminent French physicians have shown that the acid of vinegar is much more powerful than alcohol in producing injury to the liver. Indigestion is certain to follow the use of this chemical substance, either by itself or in the form of pickles: A single teaspoonful of vinegar is sufficient to prevent the action of the saliva upon the starch contained in an ordinary meal, as shown by Prof. William Roberts, of England, a few years ago.

Vinegar is often adulterated with muriatic acid, commonly known as spirits of sea salt, a powerfully corrosive poison which injures the teeth and other organs with which it comes in contact. So-called good cider vinegar generally contains quantities of vinegar eels, which may be seen swimming about when a glass or bottle containing a portion of the vinegar is held up to the light. Vinegar eels, as has been recently discovered, often take up their abode in portions of the alimentary canal, becoming parasites like tapeworms and other similar unwelcome guests.

Condiments the Cause of "Gin Liver."

Condiments, mustard, pepper, pepper sauce, ginger, horseradish, and the like must all be discarded for the reason that they are not foods at all, but simply irritants. They give an unnatural flavor to the food, and excite the palate and the stomach in an unnatural way, creating an artificial demand

for food, thus leading to overeating, in this way producing catarrh of the stomach and diseases of the liver and other vital organs. Professor Boix has recently shown that pepper is six times more active in producing the so-called "gin liver" than is gin itself. Cirrhosis, inflammation of the liver, inflammation of the spleen, chronic constipation, gall stones, hemorrhoids, and various other ailments, may be directly traced to the use of pepper and other condiments of like character.

Cane Sugar a Cause of Disease.

Cane sugar, while properly classed as a food, and digestible in the small intestine, is nevertheless hardly to be considered a natural food substance, for it is never found in nature in the condition in which it appears upon our tables. The acid of fruits is not neutralized by the addition of cane sugar. The use of cane sugar with acid fruits is objectionable. It is better to combine acid with sweet fruits, or if necessary, to avoid acid fruits. Dried fruits, such as figs, are rendered very digestible by steaming. Cane sugar is not digested in the stomach; it gives rise to fermentation and acidity, and is often a source of irritation. Its use is unnecessary, as starch, which constitutes a large per cent of all foods of vegetable origin, is wholly converted into sugar by the process of digestion. Brandel, an eminent German chemist, observed, in his experiments upon a dog, that a solution of cane sugar having a strength of less than six per cent, caused irritation, with reddening of the mucous membrane. A ten-per-cent solution produced a dark red color with great irritation; and a twenty-per-cent solution gave rise to still greater irritation, and produced such distress that the experiment was terminated. The author has met many cases of grave stomach disorder in which evidently the chief cause was the free use of sugar either in

the form of candy, or in connection with the use of coffee, oatmeal mush, or other so-called "breakfast foods." According to these observations, three ounces of sugar taken in connection with a full meal would produce a solution in the stomach of sufficient strength to give rise to a decided gastric irritation.

Ogata, in experimenting upon dogs for the purpose of determining the effects of cane sugar upon digestion, observed that the addition of one third of an ounce of cane sugar to a meal of meat reduced digestion one fourth.

Cane sugar is derived from roots and grasses and other coarse vegetable growths. One of the four stomachs of the cow digests cane sugar readily, but cane sugar is not digestible in the human stomach, and hence is not adapted to human nutrition.

The sugars to which the stomach is naturally adapted are, milk sugar, or the sugar which is normally found in milk; malt sugar, which is produced by the action of the saliva upon the starch; and fruit sugar, or levulose, the sweet element of fruits, also found in honey. Fruit sugar in the form of sweet fruits,— as raisins, figs, prunes,— and malt sugar, which may be produced atrificially by digesting starch with diastase (malt honey or meltose), should be used in place of cane sugar.

In the process of digestion, starch is converted into fruit sugar, passing through some thirty different stages. Ordinary cooking or boiling starch converts it into paste; this renders its digestion in the stomach possible, if it is retained there for a sufficient length of time. The saliva cannot act upon raw starch. A more prolonged cooking at a higher temperature produces a higher form of dextrin, which is soluble, and which is more easily acted upon by the saliva. Cooking at a temperature of about 300° F. produces acro-

odextrin, which is rapidly converted into malt sugar when brought in contact with the saliva.

Recent experiments show that maltose is much more easily digested and utilized by adult persons than are cane and milk sugar, and hence is much more wholesome and less likely to cause fermentation. Fruit sugar and levulose are still more easily assimilated, requiring no digestive change. Lactose or milk sugar is easily assimilated by young infants, but experiments have shown that the digestion and appropriation of milk sugar rapidly diminishes after the age of two years, being four times greater in an infant than in an adult. Cane sugar is the least digestible of all sugars, and is the least easily appropriated by the system. This fact is shown by the prompt appearance of cane sugar in the urine when it is freely eaten in the form of syrup, confectionery, or otherwise. A liberal use of sugar thus becomes the cause of diabetes, a rapidly increasing malady.

The free use of cane sugar at the table and in cooking, in the form of preserves, syrups, and molasses, and sweet beverages, is unquestionably a most prolific source of injury to the stomach. It is no longer difficult to dispense with this toothsome but mischief-making substance, since most excellent and wholesome substitutes are provided at a price which renders them accessible to all who are not able to supply themselves with an abundance of sweet fruits, especially raisins and figs. Dates are not altogether to be commended, for the reason that they are prepared by soaking in molasses or by a liberal addition of cheap sugar. This is not true of the finest variety of Tunis dates, but is practically universally true of Turkish and Egyptian dates, the common date of commerce, which are in their native state very dry and quite unpalatable. The

natives prepare them by stewing, as apples and other dry fruits are prepared in this country.

Sorghum, maple sugar, and maple syrup are essentially the same as cane sugar and molasses, the sweet element being the same under another name. The sugar of honey is less likely to produce indigestion than cane sugar, but because of the admixture of various foreign substances which are gathered by the bees in the collection of sweets from many different sources, honey disagrees with many persons when freely used.

The glucose of commerce is manufactured from the starch of corn and other substances by boiling it with sulphuric acid. This form of sugar is quite unlike the sugar formed by the digestive processes. There is no doubt that the large use of glucose, or grape sugar, in the form of candy, syrups, adulterated honey, and various other sweets which are in common use, is responsible for a very large number of cases of diabetes, a disease which is rapidly increasing.

Dextrinized Cereals.

Insufficient cookery is an evil which is most of all conspicuous in our modern cuisine. Kettle-cooked cereals of farinaceous foods, such as preparations of wheat, oats, corn, etc., and starchy vegetables, are always imperfectly cooked, for the reason that a temperature of 212° F. is barely sufficient to convert the starch into paste. A temperature of about 300° is required to convert the starch into dextrin, which is necessary to render it easy of digestion. This thorough cooking also develops peptogenic properties which aid the stomach in the secretion of the gastric juice. Starch which has been thoroughly dextrinized by cooking in an oven until slightly brown is quickly converted into malt sugar by the action of

the saliva. Malt sugar, being very soluble, passes readily into the intestines, where it is further changed and promptly absorbed.

In the ordinary process of cooking, especially in the preparation of the so-called "breakfast cereals,"— oatmeal, cracked wheat, etc.,— it is seldom that more than half the starch undergoes even the first stage of conversion, hence it cannot be acted upon at all by the saliva, which does not begin the process of digestion with raw starch, but can act only on soluble starch, or amylodextrin, which for oatmeal and cracked wheat requires several hours' boiling. In baking, a portion of the starch is converted into erythrodextrin. In dry cooking, or toasting, the complete dextrinization of the starch, converting it into achroodextrin, is indicated by a distinctly brown color.

The use of imperfectly cooked cereals is without doubt responsible for a great share of the prevailing dyspepsia among civilized people. Oatmeal porridge, cracked wheat, and similar preparations are not the most wholesome foods, and can be digested only by sound stomachs. When cream and sugar are added, we have a combination well calculated to create a magnificent dyspepsia.

Cereals must be cooked dry in order to be thoroughly cooked. It is often necessary that they be first cooked moist, and afterward subjected to dry cooking. When prepared in this way, cereals are well adapted to the human stomach, are easily digested, and in combination with fruits and nuts constitute an ideal dietary. In fruits, digestion in the ripening process is carried still farther than in the most thoroughly cooked cereal; for the starch of the green fruit is in the ripening converted into levulose, the form of sugar into which starch is converted at the moment of absorption.

This thorough dextrinization or predigestion of starch is the foundation of most of the valuable health foods prepared by the Battle Creek Sanitarium Health Food Co. and its branches. A brief description of these health foods may be in place.

Zwieback consists of light bread, which, after thorough baking, has been cut in slices, and returned to the oven, where it is baked a second time at a slow heat until each slice is browned throughout the whole thickness. By this means the entire loaf is as thoroughly cooked as the outside crust, the superior sweetness and digestibility of which has long been recognized.

Granola consists of a combination of grains which are first made into a biscuit, which is baked in a slow oven until slightly browned, then coarsely ground.

Granose is a preparation in large, thin, toasted flakes, each flake representing a single grain of wheat. If freely used, it renders laxative pills and mineral waters unnecessary. It is a blood-, brain-, and bone-building food, containing all the elements of nutrition. It contains the whole wheat, yet the bran is perfectly subdivided, so as to be nonirritating. The starch is perfectly cooked and dextrinized, and ready to be instantly dissolved in the stomach and converted into sugar. It is the only dry food that can be perfectly masticated without teeth, hence is good for infants as soon as they begin to cut teeth, and for old people who have lost their teeth.

Browned Rice consists of rice which has been subjected to the prolonged action of heat at a high temperature until slightly browned. It is partially digested and readily assimilated, being quickly soluble in the digestive fluids. It makes a very delicious article of food, much superior to ordinary rice, and cannot be made heavy or pasty.

Crystal Wheat is a cereal preparation consisting of wheat which has been thoroughly cooked, dried, and browned. It only requires soaking in order to prepare it for use as food. It is improved, however, by steaming, either in an ordinary steamer or by placing in an oven, after adding a sufficient quantity of water.

Protose is a vegetable substitute for meat, consisting of the proteids obtained from vegetables, combined with nuts. It looks much like meat, tastes like meat, and has the chemical composition of meat; hence, it is a vegetable substitute for meat. A pound of protose contains twenty-five per cent more nourishment than does a pound of meat, and has the advantage that it is free from the uric acid contained in beef. Beef contains sixteen grains of uric acid to the pound.

Malted Nuts is a preparation in which nuts are combined with cereals, the cereals having been perfectly digested through the action of vegetable diastase. In other words, it is a food containing practically no starch, the starch having been converted into maltose, and so prepared for prompt absorption, maltose being the most easily assimilable form of sugar.

Toasted Wheat Flakes, Granose, and Corn Flakes are cereal preparations in which the grain is first thoroughly cooked, then partially dried and compressed into thin flakes, which are afterward baked until slightly brown, by which process they are thoroughly dextrinized and prepared for prompt digestion and assimilation.

The list of scientifically prepared health foods includes several other carefully prepared articles. The above are the most commonly known. However, the attention of the public should be called to the fact that there are at present numerous

imitations in the market, some of which possess in part the merits of the original, while others are altogether unwholesome.

Raw foods, with the exception of ripe raw fruits and nuts, are acted upon in the stomach only to a very slight extent. The starch is not changed at all, and on this account raw substances are very imperfectly broken up in the stomach, so that the gastric juice cannot gain ready access to the proteids or albumins, which are entangled with the starch. In experiments made in the laboratory of the American Medical Missionary College, it has been shown that raw wheat undergoes very little change in the stomach. The same is true of other grains and vegetables. The idea is sometimes advanced that raw foods are preferable to cooked foods. This is true only as relates to certain fruits and nuts, and then only in relation to soft fruits and nuts, which can be easily reduced by mastisation to a creamy paste. Raw foods are certainly less likely to ferment in the stomach than cooked foods, at least when properly eaten, and there are doubtless certain cases in which the use of raw foods, particularly fresh fruits, may be, for a time at least, adopted with advantage. Meats of all sorts are rendered less digestible by the cooking process. The facts in relation to this question enable us to say that, on the whole, vegetable foods are improved by cooking, while animal foods are rendered less digestible; and hence the use of raw food is not, on the whole, to be commended, unless one intends to confine himself to a meat diet, and even then cooking become quite necessary as a precaution against infection with trichinæ and other parasites.

Hasty Eating.

The bolting of food, or swallowing it without proper attention to mastication, is an almost universal habit, especially among Americans. In the feeding of their horses, farmers recognize the importance of thorough mastication, and to secure this result frequently put into the manger along with the oats or the other feed a quantity of small stones, which compels the animal to take the food into his mouth in small quantities, thus forbidding hasty eating, and insuring thorough chewing. The farmer would be himself profited by the application of this same ingenious device; but man being an intelligent creature, it is scarcely necessary that pebbles should be added to his food to secure its proper mastication. An appeal to his intelligence should be sufficient.

An eminent English physician, in an article recently published in a leading medical journal, claims to have proved that the nutritive value of food is very greatly increased by very prolonged and thorough chewing. The grounds upon which he bases his claims seem entirely reasonable, and are quite in accord with general experience. The average American, however, is in such a hurry that he prefers to take his food in the form of slops of some sort. Soups, mushes, soft bread, purées, custards, and similar dishes, always occupy a prominent place in the average American bill of fare, and the result is a loss of teeth from lack of use, overfilling of the stomach because of the haste with which a miscellaneous mixture of comestibles is forced into it, and resulting indigestion.

Cereals must not only be cooked dry in order to be promptly digested, but they must also be eaten dry. Experiments have shown that one ounce of dry, well-cooked cereal food, as granose, well-masticated, produces two ounces of saliva; whereas

mush, gruel, and other moist foods cause the secretion of only a very small amount of saliva, less than one fourth that produced by the same food in a dry state. In the wonderful economy of nature, nothing is thrown away. If the food is moist, saliva is not needed to moisten it, and the impression of dryness not being made in the mouth, the salivary glands are not stimulated to pour out the fluid that is necessary not only to moisten it but to digest the food. Fishes must of necessity take their food moist, and hence have no salivary glands; whereas cows, which naturally take their food in a dry state, have large salivary glands. Human beings are likewise furnished with proportionately large glands for the secretion of saliva.

While it is better that the food should be taken dry, so as to require thorough mastication, it should also be remembered that in the taking of foods which are already sufficiently moist, mastication is all the more essential, as the secretion of saliva being more scanty, a longer time will be necessary for the development of the required amount.

Thorough mastication serves as an excellent means of preventing overeating, as time is afforded for the absorption of a sufficient amount of food to reach the hunger centers in the brain, and thus arrest the demand for nutriment. Overeating is a fault closely associated with hasty eating.

The Daily Ration.

The amount of food required depends upon how the individual is employed, or the amount of work he does, and the temperature of the air to which he is exposed. A large person naturally needs more food than a small one, although the proportion is not a direct one; that is, a person who weighs two hundred pounds does not require twice as much food as

one who weighs one hundred pounds. The actual requirements of the person of lesser weight are about two thirds as much as the amount demanded by the larger. The proportionately larger amount of food required by the smaller person is chiefly due to the fact that the skin surface of the person of smaller weight is larger in proportion to the size than that of the larger person. A person weighing one hundred pounds, for instance has a skin surface of about thirteen square feet, or nineteen square inches for each pound of weight, whereas a person weighing two hundred pounds has a skin surface of about twenty-one square feet, or fifteen square inches per pound.

Three fourths of all the food eaten is required for fuel; that is, it is burned within the body to maintain the body heat, hence the amount of surface in relation to weight is of practical importance. A child weighing twenty pounds has a skin surface of thirty-five square inches for each pound of weight, and loses heat so rapidly that it requires more than one fourth as much food as a person weighing one hundred and sixty pounds, although his weight is only one eighth as much as that of the grown person; that is, the infant requires twice as much food in proportion to its size as does the adult. This is the primary reason why infants and young children require more frequent feeding than do adults.

For a similar reason, men generally eat more than women. Their exposure out of doors to a lower temperature, and their greater muscular activity also create a demand for a larger amount of food. Persons who live indoors and those of sedentary habits require much less food than those who lead an active, out-of-door life. For example, a person sitting quietly indoors, with the air at a temperature of seventy degrees will consume about nine tenths of the food he eats in

heat production, employing only one tenth in work, a total of about eight thousand five hundred heat units in all. Another person of the same weight, engaged in active work out of doors, will utilize at least one fourth of the total food consumed in work, the other three fourths serving to maintain heat, a total of about ten thousand five hundred heat units. This difference of two thousand heat units would represent, in food, about two ounces of fat or four ounces of starch. If the sedentary person eats as much as the man who works out of doors, this four ounces of starch consumed will be stored up in his body in the form of fat or so-called residual or reserve tissue, so he will gain in flesh. After a time he will become overburdened with surplus material; in other words, obese. On the other hand, if the man working out of doors eats only the amount required by a sedentary life indoors he will be obliged to consume a portion of his own body in order to maintain his body temperature, and will be certain to lose several ounces in weight each day so long as the food supply remains deficient.

The normal daily ration, as determined by experiments by the author and others, consists of sixteen ounces of starch, three ounces of albumin, and one and one-half ounces of fat. These figures represent water-free substances; that is, the food stuffs are calculated as being perfectly dry. The actual weight and bulk will of course vary with the amount of water added in its preparation for the table, the average being three to four times the amount named for dry food, or four to five pounds of ordinary food, including fruits and such liquid foods as milk and soups.

The accompanying table gives approximately the amount of different elements and the number of food units found in various substances as served at the table when prepared in accordance with recognized hygienic recipes.

Table showing the amount of the several classes of food elements in given weights of various food substances as usually eaten, and the number of food units.

Food	Measure	Weight oz.	Proteid	Fat	Carbo.	Food Units per oz.
Granola	.5 pt.	4.2	15.	3.	75.	113.200
Granose	1. biscuit	.7	15.4	2.3	79.1	116.600
Zwieback	1. piece	1.1	13.6	2.	70.	103.700
Graham Crackers	2.	1.	9.8	13.6	70.	127.300
Whole Wheat Wafers	6.	2.5	9.8	13.6	70.	127.200
Rolls	3.	2.	11.7	1 2	80.	109.500
Graham Bread	1.	1.	9.5	1.4	53.3	76.900
Whole Wheat Bread	1.	1.	8.7	6.	64.	99.500
White Bread	1.	1.	5.3	.8	48.3	63.700
Nut Gravy Toast	1. piece	6.	4.5	4.	13.	31.300
Prune Toast	1. piece	6.	3.3	.3	42.1	53.100
Berry Toast	1. piece	6.	3.2	1.5	24.1	35.600
Cream Toast	1. piece	6.	5.4	7.4	15.4	43.900
Crystal Wheat	.5 pt.	7.	5.7	3.	29.5	49.100
Gluten Mush	.5 pt.	8.2	12.	.6	22.	43.400
Graham Mush	.5 pt.	7.	5.8	.9	35.8	51.100
Cornmeal Mush	.5 pt.	8.6	2.1	1.2	18.5	27.000
Wheatose	.5 pt.	7.	5.7	.8	29.5	43.500
Macaroni	.5 pt.	6.5	10.0	2.	75.	91.500
Rice, Boiled	.5 pt.	5.7	2.8	.1	24.4	31.800
Baked Beans	.5 pt.	7.3	6.9	2.5	19.6	38.100
String Beans (Canned)	.5 pt.	7.7	1.1	.1	3.8	6.100
Green Peas (Canned)	.5 pt.	8.2	3.6	.2	9.8	16.700
Green Corn (Canned)	.5 pt.	8.	2.8	1.2	19.	28.500
Asparagus (Cooked)	.5 pt.	7.4	2.1	3.3	2.2	13.800
Spinach (Cooked)	.5 pt.	6.	2.4	4.1	2.6	16.800
Potato (Boiled)	.5 pt.	7.	2.5	.1	20.9	27.400
Tomato (Fresh)	1. ave	8.	1.6	.3	2.5	5.800
Nut Gravy (5-6 water)	.5 pt.	9.	2.7	4.4	1.6	16.800
Lettuce	.5 pt.	2.6	1.4	.3	2.2	5.200
Soup, tomato	.5 pt.	8.5	1.8	1.1	5.6	11.700
Soup, cream of pea	.5 pt.	8.5	2.6	2.7	5.7	17.000
Soup, vegetable	.5 pt.	8.5	2.9	....	.5	4.600
Malted Nuts	.5 pt.	3.8	23.7	27.6	43.9	153.300
Almond Cream (¾ water)	.5 pt.	7.8	5.2	13.7	4.3	47.100
Bromose	2. cakes	1.	19.6	24.	39.4	133.500
Malt Honey	.5 pt.	10.9	3.8	....	14.9	77.700
Nuttolene	.5 pt.	6.4	12.1	19.4	9.7	167.900
Protose	.5 pt.	4.2	21.3	10.2	2.8	60.100
Stewed Nuttolene (½ water)	.5 pt.	9.	6.	9.7	4.8	38.600
Almonds (Shelled)	.5 pt.	5.	21.	54.9	17.3	189.600
Cream	.5 pt.	8.5	2.7	26.7	2.8	75.000
Milk	.5 pt.	8.5	4.1	3.9	5.2	21.700
Butter	.5 pt.	7.4	0.6	84.4	.6	217.600
Kumyss	.5 pt.	8.5	3.7	3.6	4.7	19.700
Cottage Cheese	.5 pt.	7.7	20.9	1.	4.3	37.400
Eggs	1.	1.5	14.	10.5	....	47.000
Apples (Fresh)	1. ave.	6.	4.	....	7.2	14.000
Apple (Sauce)	.5 pt.	8.1	2.	.8	37.2	47.000
Apricot (Sauce)	.5 pt.	9.5	1.9	1.3	48.8	61.300
Bananas	1. peeled	2.	1.9	.6	28.8	36.500
Berries (Fresh)	.5 pt.	3.7	1.1	1.4	15.	22.100
Cherries	.5 pt.	9.2	1.1	.1	21.1	25.700
Dates	7. dates	2.	9.0	....	58.	77.900
Figs (Steamed)	.5 pt.	7.1	3.6	....	45.	61.500
Grapes (Fresh)	1. bunch	5.	0.6	....	14.3	17.100
Lemon	1. peeled	2.	1.0	.7	8.5	12.700
Orange	1. peeled	2.	.8	.2	11.6	14.600

Food	Measure	Weight oz.	Proteid	Fat	Carbo.	Food Units per oz.
Peach	1. peeled	3.	.7	....	4.5	6.000
Pear (Canned)	.5 pt.	9.2	.3	.3	18.	21.500
Prune (Stewed ½ water)	.5 pt.	9.2	1.2	....	22.5	27.216
Raisins (Stewed ½ water)	.5 pt.	9.2	1.2	.3	27.3	33.800
Strawberry	.5 pt.	9.2	1.1	.5	6.5	9.500
Whortleberry	.5 pt.	9.2	.8	....	5.0	9.800

Many of the quantities given in the above table, of course, are approximate only, as to amount. This is especially true of the cooked foods. In general the recipes for the prepared dishes are the same as those given in Mrs. Kellogg's "Science in the Kitchen."

How to Arrange a Bill of Fare.

It is of the highest importance in arranging the bill of fare to provide the proper proportion of the different food elements. A deficiency of starch may be largely compensated for by an increased quantity of fat. This renders it possible for a person to subsist indefinitely upon a diet consisting wholly of fruits and nuts. From such a dietary starch would be excluded, but would be represented in moderate amounts by its equivalent, sugar, and further replaced by fat. It is impossible, however, to replace the albumin or proteid by any other element, hence it is of importance to make sure that each bill of fare contains the proper amount of proteid; that is, the equivalent of three ounces of dried albumin. The following table shows the amount of peas, beans, lentils, and other foods required to furnish three ounces of albumin for the daily ration: —

	Ounces.		*Ounces.*
Peas	13.8	Walnuts	16.2
Beans	11.1	Peanuts	11.6
Lentils	11.5	Protose	13.9
Almonds	14.2	Cornmeal	30.9
Pecans	27.2	Whole-wheat bread	34.4

	Ounces.		Ounces.
Oatmeal	19.8	Peaches	428.5
Rice	44.7	Oranges	375.0
Potato	136.6	Strawberries	272.7
Squash	272.7	Cherries	428.5
Beets	230.7	Grapes	500.0
Tomato	187.5	Banana	157.9
Turnips	200.0	Porterhouse steak	15.5
Asparagus	166.6	Cream	111.1
Cabbage	157.9	Eggs	21.5
Apples	750.0	Milk	73.1

Albumin or some equivalent proteid, such as gluten, is the most essential element. A deficiency in albumin causes pallor from impoverished blood and weakness from wasting of the blood and other vital tissues.

By reference to the above table it will be easily possible to prepare a full bill of fare which shall certainly contain the needed amount of albumin. Two, three, or half a dozen constituents may be selected.

As the amount given for each substance is sufficient to furnish the albumin necessary for one day, we may easily construct a bill of fare by taking of each of the articles selected, the amount necessary to give it the desired proportion of the whole. For example, if one desires to live for one day upon bread and beans, he may take such quantities of each as will give him one half the needed albumin in the form of bread and the other half in the form of beans. These quantities will be obtained by dividing by two the quantities given in the table, of bread 17.5 ounces, of beans 5.5 ounces,— a little more than a pound of bread with a trifle in excess of a third of a pound of beans. If one desires different proportions, they may be easily arranged. To obtain two thirds of the albumin from beans, and one third from bread, one would take 7.7 ounces of beans and 11 ounces of bread. A more varied bill of fare may be easily arranged, as for example the following, in which four articles are selected in convenient proportions:

Peas, 3.5 ounces (one-fourth part); potatoes, 13.7 ounces (one-tenth part); protose, 3.5 ounces (one-fourth part); bread, 13.6 ounces (four-tenths part). If the food is taken at two meals, the quantities for each meal must be properly proportioned, the amounts being such as to aggregate the quantity required for one day's rations.

It will be observed that the amount of albumin in fruit is so very small that it may be ignored in arranging the bill of fare; i. e., any ordinary juicy fruit may be added to the other foods selected, without running the risk of any harmful results, provided the total quantities are kept within reasonable bounds. The total bulk of the food taken at a single meal must not exceed two and a half to three pints or pounds. In many cases the amount may be with great advantage made considerably less than this by avoiding the use of liquid foods or juicy fruits.

Uric Acid.

While a deficiency of albumin is productive of serious mischief if continued for a considerable length of time, because of the lack of blood-, brain-, nerve-, and muscle-building material, a considerable excess of proteids results not much less disastrously. There is not the same provision for the storage of proteids that is made for the disposal of surplus starch or fat. The latter are easily converted into adipose tissue, which may accumulate in quantities so great as to actually double a person's weight. Proteids, on the other hand, if not used, become at once a source of injury. When perfectly oxidized, or burned, proteids are converted into urea, which is carried off through the kidneys; but an excess cannot be readily burned for the reason that the supply of oxygen is exhausted, and hence is left in an imperfectly burned state,

and may be called "tissue cinders," of which uric acid is one of the representatives.

Uric acid diminishes the alkalinity of the blood, hence lessens resistance to disease. It irritates the nerves and tissues, producing rheumatism, gout, neuralgia, paralysis, and various other grave disorders. The free use of meat, and even the use of eggs and nuts in large excess, may give rise to this excessive formation of uric acid, and as a result may lead to the development of the uric-acid diathesis in some of its many forms, especially rheumatism, sick headache, and so-called nervous exhaustion.

The following table shows the amount of uric acid contained in some ordinary foods, as determined by Professor Hall, of Owens Medical College, Manchester, England: —

Table showing the amount of uric acid in common foods.

	Grains of Uric Acid Per Pound
Fish (salmon)	8.15
Mutton	6.75
Veal	8.14
Pork	8.48
Sweetbread (thymus)	70.43
Beefsteak	14.45
Liver	19.26
Wheat Bread (white)	0.00
Oatmeal	3.46
Rice	0.00
Peas (including the hulls)	2.54
Beans (including the hulls)	4.17
Potatoes	0.14
Cabbage, lettuce	0.00
Cauliflower	0.00
Asparagus	1.50
Eggs	0.00
	Grains of Uric Acid Per Pint
Lager Beer	1.09
Ale	1.27
Porter	1.36
Tea	3.22
Coffee	4.53
Milk	0.00

Deficiency of fat leads to loss of energy and generally impaired nutrition. This fact accounts for many cases of

failure on the part of those who have undertaken to make a reform in diet, but who have neglected to supply sufficient fatty material in the form of nuts or some other equivalent fat-containing substance. The amount of fat required per diem will be furnished by the quantities of various substances rich in fat shown in the following table, which indicates the quantities of various food substances required to furnish 1.5 ounces of fat:—

Table Showing the Amount of Various Food Substances Required to Supply the Quantity of Fat Daily Needed.

	Ounces.		Ounces.
Almonds	2.7	Peas	78.9
Brazil nuts	2.2	Beans	50.0
Butternuts	2.4	Lentils	78.9
Chestnuts	27.7	Wheat flour	136.3
Cocoanuts	2.9	Granose	65.2
Filberts	2.3	Granola	50.0
Hickory nuts	2.2	Oatmeal	21.1
Peanuts	3.8	Cornmeal	39.4
Pecans	2.1	Rice	166.6
Walnuts	2.3	Potato	750.0
Malted nuts	5.5	Cream	5.6
Protose	14.7	Milk	37.4
Nuttolene	7.7	Eggs	14.3

From the above table it may be very readily seen that there is a special class of substances rich in fats which must be relied upon as a source for this element, and that the amount of fat contained in cereal foods as wheat flour, and corn and rice products is so small that it may be practically ignored. No one could eat in one day so much as eight and a half pounds of wheat flour, nor even two and a half pounds of corn meal. So in practice one may calculate bread stuffs and cereals as furnishing no fat, supplying the needed amount by adding to the bill of fare a sufficient amount of foods known to be rich in this element. It may be proper to call attention to the fact shown by reference to the previous table that

fourteen ounces of protose — a vegetable meat — contain just the proper amount of both fat and albumin, needing only the addition of the proper amount of some substance rich in starch or fruit or malt sugar (16 oz.) to constitute a complete day's ration. Thus fourteen ounces of protose and a pound of rice would supply adequate nourishment for a day, and in right proportion. If the starch is furnished by whole-wheat bread, however, we must diminish the protose somewhat, as whole-wheat meal contains quite a large percentage of albumin or proteid in the form of gluten. The starch will be supplied by about one and a half pounds of bread, which will supply two-thirds of the albumin. We may then take one third of the albumin in the form of protose (about five ounces) and two thirds of the fat in the form of almonds (two ounces) or cream (three and two-thirds ounces) or any other fat containing food in proper proportion, as may be easily determined by the use of the above table.

Cane sugar cannot be substituted for fat or starch, on account of its irritating effects upon the stomach, as previously shown. Sweet fruits and fruit juices, particularly prunes, raisins, and figs, and meltose or malt honey, may be substituted for starch, and for fat in part.

Balanced Bills of Fare.

The following represents a few simple balanced bills of fare. The quantities given being one half the amount required daily, or the amount needed for a single meal by a person taking his food in two daily meals of equal quantity. The total number of food units, 1,270; amount of dried, water-free food substance, 10.25 ounces (total daily ration 20.50 ounces); required amount of each element,— proteids, 1.5 ounces; fats, .75 ounces; carbohydrates, 8 ounces.

	Pints	Ounces
1.		
Boiled potato	.6	8
Spinach	.4	4
Tomato		4
Baked beans	.5	8
Green corn	.5	8
Whole-wheat bread		4
Total		36
2.		
Baked beans	.6	9
Steamed rice	.8	9
Zwieback		6
Total		24
3.		
Protose	.6	4
Zwieback		5
Strawberries	1.	18
Total		27
4.		
Green corn	.3	5
Apples		4
Peaches		4
Granose biscuit		8
Total		21
5.		
Granola	.8	7
Almond cream	1.	17
Total		24
6.		
Granola	.7	6
Milk	1.	17
Banana		6
Total		29
7.		
Potato	.6	8
Peas	.5	8
Cottage cheese	.2	3
Whole-wheat bread		8
Total		27

The above table represents the average amount required by working men and women, and is about one sixth or one seventh larger than is required by a person of sedentary habits.

Drinking at Meals.

Hasty eating naturally leads to the drinking of large quantities of liquids to facilitate the washing of the food into the stomach. Drinking at meals likewise leads to insufficient mastication, so these two evils are associated. Liquids of all sorts are objectionable at mealtime for the reason that they diminish the flow of saliva. Cold liquids, as well as cold foods, ice cream, fruit ices, etc., are objectionable,

because of the lowering of the temperature of the stomach whereby the digestive process is stopped.

Beaumont, in studying the stomach of Alexis St. Martin, observed that a glassful of cold water lowered the temperature of the stomach contents to 70° F., and that more than half an hour elapsed before the normal temperature was regained. A temperature of 100° F. is required for digestion, hence the whole digestive process was checked for half an hour. A glassful of ice water or an equivalent quantity of ice cream would have produced a much more marked effect.

Injury from Mineral Waters.

The laxative mineral waters so extensively used throughout the world are highly detrimental to digestion. They afford temporary relief from certain uncomfortable symptoms, and stimulate activity of the bowels at the expense of more or less permanent injury, lessening the secretion of the gastric juice and diminishing its activity. There is no special virtue in any of these waters because they are natural products. They are simply chemical solutions, and their continued use has been clearly shown to be detrimental.

The habitual use of alkaline and saline mineral waters produces hypopepsia, or diminished power of the stomach to form gastric juice, and also induces a condition of chronic catarrh of the intestines, a very obstinate and sometimes almost intractable disease.

Sour stomach and other forms of indigestion are the certain results, sooner or later, of the too free use of liquids at mealtime. If liquids of any sort are to be swallowed, take a fe wsips of water at ordinary temperature or hot water just at the close of the meal. Fruit eaten at the close of

the meal or with other foods during the meal, generally obviates entirely the necessity for liquids of any sort at mealtime.

Both tea and coffee injure digestion, not only because of their harmful effects upon the nervous system, but because of their interference with the digestion of starch, one of the most important food elements. Half a cupful of tea is amply sufficient to wholly prevent the digestion of the starch taken at an ordinary meal. Nothing could be a more unscientific or absurd combination than the conventional tea and toast.

Too Frequent Eating.

Healthy digestion requires at least five or six hours, and one or two hours for rest before another meal is taken. This makes six or seven hours necessary for the disposal of each meal. If ordinary food is taken at shorter intervals, the stomach must suffer disturbance sooner or later, since it will be allowed no time for rest. Again, if a meal is taken before the preceding meal has been digested and passed from the stomach, the portion remaining, from its long exposure to the influence of warmth and moisture, is likely to undergo fermentation, in spite of the preserving influence of the gastric juice. Thus the whole mass of food is rendered less fit for the nutrition of the body, and what is still more serious, the stomach is liable to suffer permanent injury from the acids developed.

Too frequent eating occasions too long contact of the acid contents of the stomach with the gastric juice, which produces catarrh and ultimately ulceration of that organ.

The number of daily meals required depends somewhat upon the age, and especially upon the character and the quantity of the food taken at the meals. There can be no ques-

tion that in general the practice of eating twice a day is much to be preferred to more frequent meals. This custom prevails with the great majority of human beings, and has been a prevalent custom in the world from the most remote ages.

According to Hippocrates, the ancient Greeks ate but two meals a day. The same was true of the ancient Hebrews and Persians. This is also the custom of the natives of India, of South America, and of many semicivilized nations. Among the savage tribes, one meal a day is the prevailing custom. The Eskimo walrus hunter sets out fasting in his *kajak* on a day's hunt at the break of day, but eats nothing until after he returns from his perilous work, just before sunset.

The modern frequency of meals is the outgrowth of the gradual losing sight of the true purpose of the eating of food, the gratification of the palate being too much considered, instead of the nourishment of the body. That the system can be well nourished on two meals a day is beyond controversy, seeing that not only did our vigorous forefathers, many centuries ago, require no more, but that thousands of persons in modern times have adopted the same custom without injury, and with most decided benefit to themselves. Students, teachers, clergymen, lawyers, and other literary and professional men are especially benefited by this plan. The writer has followed this mode in eating for more than thirty years, and with great benefit. The special advantages gained by it are, (1) the stomach is allowed a proper interval for rest; (2) sleep is much more recuperative when the stomach is allowed to rest with the balance of the body; (3) digestion cannot be well performed during sleep.

Dujardin-Beaumetz, an eminent French physician, Bouchard, and other well-known European authorities, insist that

seven hours is the proper length of time to be allowed for the digestion of each meal. If this plan is followed, and the proper length of time allowed to elapse before retiring after the last meal, it will be found impossible to make any arrangement by which opportunity can be secured for the necessary eight hours' sleep at night. Not more than two meals can be taken when a person complies with all the laws of health.

If more than two meals are suited to any class, it is those who are engaged for twelve or more hours per day in severe muscular labor. Such persons are better prepared to digest a third meal than those whose occupation is mental or sedentary, and they may at least take it with less detriment; though a third meal is not needed, even for such, provided the two meals are taken at suitable hours. For many years the practice at the Battle Creek Sanitarium has been to furnish its guests with two regular meals daily, the first at 8:00 A. M., the second at 3:00 P. M. The doctors, nurses, and other employees, numbering at the present writing something more than eight hundred, are also furnished with but two meals, at 6:00 A. M. and 1:30 P. M. The universal testimony of all who have become accustomed to these hours for eating is that more work and better work can be accomplished than when three meals are taken. In cases requiring more than two meals, as when liquid food or only small quantities of food can be taken at a time, we find it wise to supply in addition two minor meals, at 12:00 M. and 7:00 P. M. These meals consist of fruit juice, fruit purée, some ripe, juicy fruit, or some simple liquid food.

Eating late at night, when the muscular and nervous systems are exhausted by the labors of the day, and retiring

to rest soon after, is one of the most positive dyspepsia-producing habits of modern times. A sleeping stomach is a slow one. Secretion must of necessity be deficient in both quantity and quality, owing to the exhausted condition of the system; and with the further obstacle afforded to prompt digestion by the slowing of the heart action and other vital operations during sleep, it is impossible that there should be other than disturbed digestion and restless sleep in consequence. It is under these circumstances that many persons suffer with obstinate insomnia, bad dreams, nightmare, and similar troubles, from which they arise in the morning, unrefreshed, the work of assimilation having been hindered by the disturbed condition of the body.

No food should be taken within four hours before retiring. This will allow the stomach time to finish its work and pass the food into the small intestine, where the work of digestion may be carried on to completion without disturbance of the rest of the economy. If an exception is made, only fruit or fruit juice should be taken.

If a third meal is taken, it should be very light, preferably consisting of ripe fruit only. The custom which prevails in many of the larger cities, of making dinner the last meal of the day, eating of foods the most hearty and difficult of digestion as late as 6:00 or even 8:00 P. M., is one which must be most emphatically condemned. It should be tolerated only by those who convert night into day by late hours of work or recreation, not retiring until near midnight. But in such cases a double reform is needed, and so there can be no apology offered for this reprehensible practice, on any physiological grounds.

Eating between meals is a gross breach of the requirements of good digestion. The habit many have of eating

fruit, confectionery, nuts, sweetmeats, etc., between meals, is a certain cause of dyspepsia. No stomach can long endure such usage. Those who indulge in this manner usually complain of a poor appetite, and wonder why they have no relish for their food, strangely overlooking the real cause, and utterly disregarding one of the plainest laws of nature.

This harmful practice is often begun in early childhood; indeed, it is too often cultivated by mothers and the would-be friends of little ones, who seek to please and gratify them by presents of confectionery and other tidbits of various sorts. Under such indulgence, it is not singular that so many thousands of children annually fall victims to stomach and intestinal diseases of various forms. In great numbers of cases, early indiscretions of this kind are the real cause of fully developed dyspepsia in later years. What a sad thought that the lives of so many thousands should be thus damaged and their characters more or less depraved by the morbid influence of disordered digestion resulting from parental indiscretion.

Irregularity in Time of Meals.

Another cause of dyspepsia, which is closely related to the ones just mentioned, is irregularity respecting the time of meals. The human system seems to form habits, and to be in a great degree dependent upon the performance of its functions in accordance with the habits formed. In respect to digestion, this is especially observable. If a meal is taken at a regular hour, the stomach becomes accustomed to receiving food at that hour, and is prepared for it. If meals are eaten irregularly, the stomach is taken by surprise, so to speak, and is never in a proper state of readiness for the prompt and perfect performance of its work. The habit

which many professional and business men have of allowing their business to intrude upon their meal hours, frequently either wholly depriving them of a meal or obliging them to take it an hour or two later than the usual time, ultimately undermines the best digestion. The hour for meals should be considered a sacred one, not to be intruded upon, except by some unusual circumstance. Eating is a matter of too momentous importance to be interrupted or delayed by matters of ordinary business or convenience.

The habit of regularity in eating should be cultivated early in life. Children should be taught to be regular at their meals, and to take nothing between meals. This rule applies to infants as well as to older children. The practice of feeding the little one every time it cries results in most serious injury to its weak digestive organs. An infant's stomach, though it needs food at more frequent intervals than an adult's,— every two to four hours, according to age, — requires the same regularity which is essential to the maintenance of healthy digestion in older persons. Irregularity in feeding is undoubtedly one of the causes of the large number of deaths among infants from disorders of the digestive organs shown by our mortuary records.

The action of the digestive organs, like that of all the other organs of the body, is rhythmical. The discharge of the alimentary residue, the daily movement of the bowels, normally occurs after the first meal of the day. It is the result of the peristaltic movements set up by the introduction of food into the stomach. By this increased activity of the alimentary tube, the fecal matters resting in the middle and lower portions of the colon are moved downward into the rectum, thereby provoking a desire for evacuation of the bowels; while the digested food stuffs undergoing absorp-

tion in the cecum and first part of the colon, having been to some degree consolidated by the absorption of the more fluid parts, are moved along the colon to make room for the newly digested material soon to enter. By this means, the activities set up by each meal move the contents of the intestine to the next station, resulting, in a healthy person, in the discharge of the alimentary residue from the body at a stated hour each day. If a meal is omitted, or if meals are taken at irregular hours, this rhythmical action is broken up, and constipation is the natural result.

It thus appears that eating at too frequent intervals is not the only evil in the way of irregularity in meals. It is far better, however, to omit a meal than to introduce into the stomach a new supply of food before that already contained in it has been properly digested and the organ given an opportunity for rest.

In the normal process of digestive activity, the hydrochloric acid, an essential element of the digestive fluid, is absorbed at the end of two and a half to three hours. Food introduced at this time cannot be promptly digested, for the reason that the stomach glands are not prepared to form hydrochloric acid, having been exhausted by the work which they have already performed, and the acid previously poured out having been absorbed. The stomach requires a certain period of absolute rest after the digestion of food before it is ready to renew the work of digestive activity.

Eating when exhausted is a most certain cause of derangement of digestion, and one to which a very large number of cases of dyspepsia may be traced. The third meal of the day is almost always taken when the system is exhausted with the day's labor. The whole body is tired, the stomach as well as other parts of the organism. The idea that by the

taking of food the stomach or any other part of the system will be immediately strengthened, is a mistake. An eminent writer on digestion says very truthfully, "A tired stomach is a weak stomach." When the stomach feels "weak and faint," rest is what is demanded, and is the only thing that will do it good; yet many people insist on putting more food into it, thus compelling it to work when it ought to be allowed to remain inactive until rested. The arm becomes wearied by constant exercise, and so does the stomach, which, like the arm, is a muscle, and in active movement during digestion. Both secretion and muscular activity are greatly lessened in a tired stomach, and the habitual disregard of this fact cannot but be disastrous to the best digestion.

Violent Exercise, either just before or just after eating, is a hindrance to good digestion. Violent exercise taken just before a meal, or exercise immediately after eating diverts the vital energies and the blood to other parts, and the stomach is thus deprived of the blood and energy required for good digestion. An English physiologist performed an experiment, which well illustrates the truth of this. Having fed a dog his usual allowance of meat one morning, he took him out upon a fox hunt, and kept him racing over the country for several hours; then he killed the animal and examined his stomach at once, when he found the meat in the same condition in which it had entered the stomach, no digestion having taken place. In another dog, fed with the same kind of food, but left quiet at home, digestion was found to be complete.

Recent experiments have shown that the muscular strength is increased very soon after eating. This is due to the digestion and absorption of the starch, whereby the muscles are furnished a fresh supply of glycogen, which is their source

of energy. It is, therefore, admissible that a very small amount of food be taken by an exhausted person, but it should be of a kind which is easily digested, and the quantity should be very small. Nitrogenous food, such as meat and eggs, is especially detrimental to a person in this condition. Thin, hot, well-boiled gruel, granola porridge, a little rice, a crust of bread, or zwieback well chewed, a cup of vegetable broth, fruit soup, a bunch of grapes, an orange, a glass of fruit juice, a bit of ripe fruit of some other kind, or a little honey or malt honey or meltose, are most suitable for this purpose. Fruit juice and malt honey are best of all.

Too Great a Variety at Meals.

While variety is necessary to promote appetite and good digestion, the stomach may be easily overworked by an excessive number of different kinds of food stuffs taken at a single meal. Animals which are adapted to complicated and varied food stuffs, like the sheep, the goat, and the cow, which, in the course of the morning's grazing, may swallow a hundred or more different kinds of herbs, have complicated stomachs. The same is true of predatory fishes, which are often provided with more than half a dozen different stomachs for the performance of their complicated digestive work. A whale has seven stomachs. Man, with a single stomach, often sits down to a feast at which the whole world of appetites and stomachs might find ample satisfaction and occupation. For example, taking an ordinary bill of fare for illustration, we find fishes sufficient in variety to occupy the seven-stomach power of the whale's digestion. There are meats of various sorts for the meat-digesting stomach of the dog; there are nuts and fruits for the fruit- and nut-digesting stomach of the monkey; grass and herbs for the

four stomachs of the cow and the goat,— variety enough to tax the digestive power of thirteen stomachs! Yet man sits down to such a task with his one small stomach, expecting to enjoy himself. Whatever pleasure he may elicit by the long procession of viands as they slip by his palate on the way to his stomach, is certain to be more than offset by the after pains of indigestion, which, when this unseemly conglomeration gathered from the bills of fare of all the beasts of creation, becomes, a few hours later, a seething, fermenting, putrescent mass, swarming with myriad germs, emitting disgusting odors, and generating poisons of various properties and potencies. There is only one animal on the face of the earth capable of digesting such a dinner, and that is the woodchuck, which, according to Professor Draper, has fourteen stomachs.

Simplicity is the corner stone of good digestion. The normal appetite is easily satisfied with a small number of foods simply and wholesomely prepared. Variety is proper enough, but the number of kinds taken at a single meal should be limited to three or four. If the bill of fare is confined to nuts, fruits, and cereals, this question becomes less important, for the reason that all fruits agree. Cereals are practically identical in their relation to digestion, and nuts are likewise practically uniform in their relation to digestion and nutrition; but when vegetables are added, substances which are very different in character, and requiring very different digestive action, are introduced, and the greatest care must be exercised to avoid harmful results from the presentation to the stomach of a too complex and arduous task.

The Temperature of Food.

Very cold foods are not easily digestible, for the reason that they chill the stomach, and thus hinder the secretion of the gastric juice. Hot foods, on the other hand, while they momentarily excite the stomach, tend to relax and lower its tone, weaken its muscles, and lessen digestive vigor. It is probable that on the whole the highest degree of digestive activity is secured by the use of food at a temperature a little below that of the body, or at ordinary temperature.

WATER DRINKING.

While water drinking at meals is not to be commended, the free use of water as a drink is of the highest importance. The practice of water drinking is quite too largely neglected. Many persons never drink except at meal times, and many seldom swallow any other beverage than tea, coffee, or some similar adulteration of water. Such persons frequently suffer seriously for lack of fluid with which to cleanse their soiled tissues. The sense of thirst, which to a normal person is a sufficient guide in relation to water drinking, is often inactive as the result of neglect. Water should be taken freely, but never in too large quantities at one time. Half a glassful or a glassful is amply sufficient for a single drinking. When several glasses of water are swallowed in quick succession, the stomach is likely to be overweighted, and becomes distended, and thus more or less permanently injured.

It is particularly pernicious to drink at once a large quantity of cold water. Such a practice is sometimes highly dangerous, especially when a person is in a state of exhaustion from violent exercise. Cold water may be taken if desired,

but should be slowly swallowed in small sips so that opportunity may be given for warming as it passes down the throat, thus preventing injury to the stomach and other possible damage. When a large quantity of water is taken at one time, the blood may be injuriously thinned. This condition will, however, probably give place to the opposite state, in consequence of the rapid action of the kidneys, induced by the sudden absorption of a large quantity of water. This is a reason why it is better to take smaller quantities of water at intervals of an hour or so, than to drink copiously at longer intervals, except in cases of dropsy, when the opposite plan is better.

In general, it is best to take water at about the ordinary temperature — 70° F. The practice of drinking large quantities of hot water before meals, or at any other time, is not to be commended, except in cases of chronic gastritis or catarrh of the stomach. In these cases, free water drinking serves a useful purpose in cleansing the stomach from accumulated mucus.

Half a glassful of hot water may be advantageously taken half an hour before each meal in cases of hyperpepsia, and the same quantity of cold water may be taken with equal benefit half an hour before eating, in cases of hypopepsia.

In cases of fever, a half glassful to a glassful of water should be taken every hour regularly.

Water should be given freely to infants and children, who are often neglected in this regard. The quantity should be small, and should be given often. Even nursing infants need attention in this respect.

Persons who have a tendency to rheumatism should drink two or three pints of water daily, even though they feel no thirst.

Water may be rendered more acceptable by the addition of fruit juice of some sort. Cane sugar should be avoided.

Fruit juices and the juice of melons may be freely used to great advantage, especially in the summer season; but in eating melons, the pulp should always be rejected. It is quite indigestible, and likely to give rise to sour stomach and other disorders. Overripe melons are exceedingly unwholesome. There is perhaps some foundation for the popular belief that the free use of melons late in the season may encourage the development of malarial fever, or a febrile disorder resembling malarial disease.

Soft water is preferable to hard water. Distilled water is best of all, when it has been properly aërated. But good spring or deep well water, if free from contamination, is perfectly wholesome, even though a little hard. No injurious effects are likely to follow the use of water containing not more than twenty to thirty grains to the gallon of lime or magnesia salts. Very hard water is injurious.

The Purest Water.

The greatest care should be taken to secure absolutely clean water; that is, water which is not contaminated with germs, animal organisms, or the excreta of animals. Distilled water is certain to be pure. Water which has been freshly boiled for fifteen or twenty minutes is safe. *Filtered water cannot be relied upon,* as the filter easily becomes contaminated, and if not thoroughly cleansed, may increase the contamination of the water passing through it. Dug wells or shallow wells are unsafe sources for drinking water. Water from surface wells is always dangerous, because of the great facility with which drainage from cesspools, vaults,

barnyards, and filth deposited upon the surface, even several rods distant, may find its way into the well by percolation through the soil. The author is acquainted with a case in which a whole family were made very sick by the use of water from a well which was contaminated with barnyard filth deposited in a hole on the opposite side of the road, fully sixteen rods away.

City water supplies sometimes becomes contaminated with dangerous germs, exposing hundreds, even thousands of people to infection. The water supply of a town in Pennsylvania some years ago became contaminated with typhoid fever germs washed down from a mountain side by a spring thaw. Nearly half the population were sick, and scores died in consequence.

Deep-bored wells, so-called artesian wells, are perhaps the safest sources of natural water supply. The well should be cased, and should penetrate one or more dense layers of rock, so as to reach what is sometimes called the second water, to insure against contamination from the surface.

Typhoid fever, cholera, malaria fever, and many bowel disorders are due to the use of contaminated water, and hence are unnecessary afflictions, as they may be prevented by proper precautions. City water supplies are seldom clean enough for use without sterilization by boiling. It is useful to remember that water may be sterilized by means of acid fruit juice. The juice of a small lemon will in half an hour destroy any disease germs which may be present in a glassful of water.

Ice as well as water may be a source of contamination, as ice is often gathered from ponds and rivers which are polluted with sewage. Such water is certain to contain germs,

which, not being injured by freezing, become active as soon as the ice is melted.

Carbonated water or water containing the juice of acid fruits is more readily absorbed than plain water. In preparing beverages from fruit juices, however, concentrated mixtures should be avoided, and also the free use of cane sugar, which is likely to increase the thirst, besides injuring the stomach and overtaxing the liver when taken in considerable quantities.

The Heart and the Blood.

"A sound heart is the life of the flesh." Prov. 14:30.
"The life of the flesh is in the blood." Lev. 17:11.

THERE is no organ in the body which bears more constant witness to the never-failing, beneficent care of an ever-present Intelligence than does the heart. From birth to death this living pump, working incessantly at the center of the citadel of life, never lays down its work for a single moment, but goes on beating, now fast, now slow, feebly or vigorously, as the needs of the body may demand. Some organs of the body perform several different kinds of work; but the heart has one single purpose, that of maintaining an active, living stream of life, perpetually flowing to and fro in the body, bathing every cell and tissue, feeding every organ, washing away waste particles, and carrying them to the outlets of the body, where they may be cast out of the vital domain.

A Living Pump.

The heart is a hollow muscle about the size of the fist, located just behind and to the left of the upper and middle portion of the sternum, or breast bone. Its position can easily be located by the fact that its movements can be felt when the hand is placed upon the chest. Its shape is conical. As it contracts, its apex taps the chest wall at a point just below the fifth rib, where its movements can easily be felt.

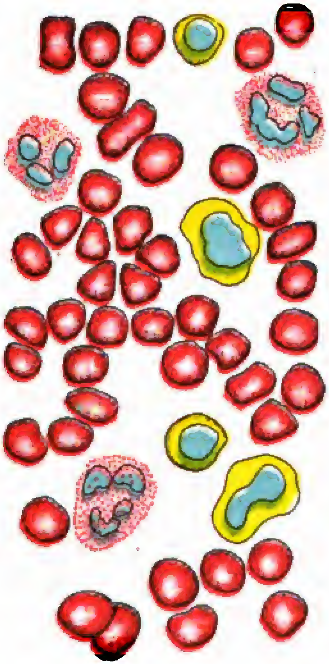
The heart is double; or rather, there are two hearts, a right heart and a left heart, almost identical in form, bound

up together in the same bundle, beating at the same time, like two men keeping step, or two carpenters keeping time with their hammers. There are valves in the heart, very similar to those in a pump, so arranged that when the heart contracts, emptying itself, the blood forced out cannot return. A very ingenious check-valve arrangement relieves the heart of the pressure of the blood which has been forced out of it.

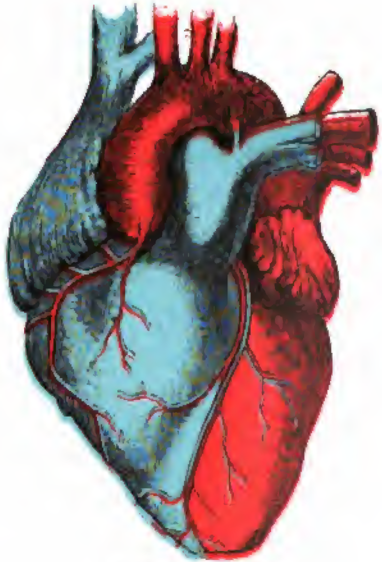
By placing the ear at a point below the fifth rib, about two inches to the left of the sternum, where the heart movements are felt, one may hear two distinct sounds made every time the heart beats, which closely resemble the syllables "lub-dup." These sounds are produced by the movement of the heart and the closure of its valves, and are analogous to the thumping and clicking sounds which accompany the operation of a water pump.

The Heart and the Blood Vessels.

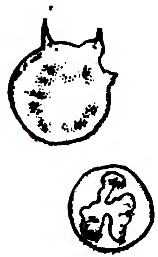
The heart, or, to speak more properly, the circulation organ, is not confined to the chest, but extends throughout the whole body, consisting of the central part, the heart, and two sets of branching tubes connected therewith. One of these sets of tubes starts at the right heart, the other at the left heart. The system which begins at the left heart extends throughout the whole body, ending at the right heart; the one which begins at the right heart is distributed to the lungs only, and ends at the left heart. In each set of tubes there is a main tube starting out from the heart, dividing into many branches, which, after becoming very small, combine to form larger ones, finally making large trunks, which again join the heart. The tubes leading out from the heart are called arteries; those which lead back to the heart are



RED AND WHITE BLOOD CELL.



THE HEART



MALARIAL PARASITES

veins. The minute vessels which join the arteries and the veins are called capillaries. (See accompanying cut.)

The walls of the arteries, and to some extent also the walls of the veins, are muscular, and hence are able to contract. The walls of the arteries and veins are thick and strong; the walls of the capillaries, however, are extremely thin, far more delicate than the finest gossamer silk. They are, indeed, transparent, so that by placing under a microscope a bit of thin tissue, like the web of the foot of a living frog, one may easily see the blood moving through these minute vessels, and study their rhythmical contractions. The contractions of the heart may also be studied, either by placing under a microscope some minute living creature, as a very young minnow, or some still smaller animal form, such as the minute animalculæ which are often seen swimming about in stagnant water. The heart of a turtle or a frog will continue to beat for some time after removal from the body.

The Systemic Circulation.

The left heart works to supply the body with blood for the building up of its tissues. The right heart works for the purpose of pumping to the lungs for purification the blood which is rendered impure by circulation through the tissues. The blood that goes out from the left side of the heart through the arteries is returned through the veins to the right side. It is then pumped to the lungs by the right heart, and after purification it is returned from the lungs to the left heart. The blood thus passes through two circuits, the larger, starting with the left side of the heart and ending with the right side, is termed the systemic circulation; the smaller, starting

out from the right heart and ending with the left heart, is called the pulmonary, or lesser, circulation.

Each heart is divided into two compartments, one which receives the blood, and the other which sends it out. The receiving compartment is called the auricle, from its fancied resemblance to an ear; the compartment which forces out the blood is termed the ventricle.

All the blood in the body, or rather, a volume of blood equal to the total amount contained in the body, passes through each side of the heart about once every minute. Some portions of the blood, however, complete the circuit in about half this time. The blood travels in the arteries very rapidly, but in the capillaries the blood movements are so slow as to be almost imperceptible. The length of the capillaries, however, is so very short that the time occupied in passing through them is brief.

The network of capillaries in the skin is spread out over an area of more than ten thousand square feet. Those of the rest of the body must be sufficient to cover many times this surface. It has been calculated that the capacity of the capillaries is several times that of the arteries, which accounts for the slow movement of the blood in this part of the circulatory system.

The capacity of the veins is twice that of the arteries, consequently the blood travels much more slowly in the veins than in the arteries. Its force is also very much less, which accounts for the fact that when an artery is cut the blood spurts out with considerable force, and in jets corresponding with the beats of the heart; whereas the flow of blood from a cut vein is in a steady stream, with very little force. The veins differ from the arteries in that they are supplied at

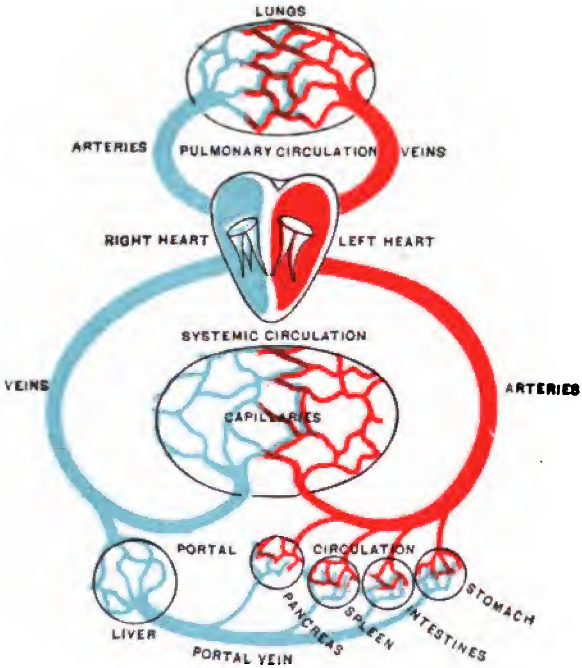
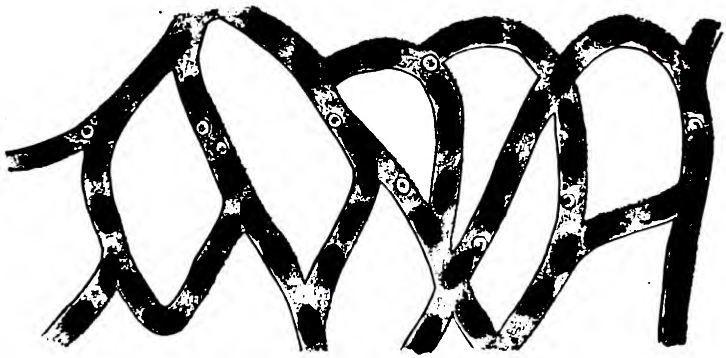


DIAGRAM OF THE CIRCULATORY SYSTEMS.



CAPILLARY CIRCULATION IN THE WEB OF A FROG'S FOOT.

various points with check valves, which prevent a backward movement of the blood.

The Lung Circulation.

In the lungs the blood is spread out in a fine capillary network, distributed in the membrane lining the air passages and air cells, which extends over an area which has been calculated to be about two thousand square feet. The pulmonary veins have a somewhat less capacity than have the pulmonary arteries.

The Portal Circulation.

This is a remarkably interesting arrangement of blood vessels connected with the digestive organs and the liver. The blood which is supplied to the stomach, the spleen, the pancreas, the intestines, and other organs connected with the processes of digestion, on entering the veins does not return at once to the right side of the heart, as does the blood from other parts of the body, but is carried to the liver, in which it is again distributed through a set of capillaries so that it may be brought in contact with the living cells of the liver. The liver cells are thus afforded an opportunity to remove impurities which may have been absorbed during the process of digestion, and also act upon the several elements of the food, and to store up the sugar from digested starch in the form of glycogen or liver starch, and to effect some necessary changes in the digested albumin.

The relation of these several systems is shown in the accompanying diagram. The infinite wisdom shown in this arrangement becomes more apparent the more thoroughly one becomes familiar with the processes of digestion and their relation to other bodily functions.

The Lymphatic Circulation.

The thin walls of the capillaries permit the escape of a considerable quantity of the blood elements into the tissues. In other words, there is a constant leakage from the blood vessels. The pressure within the vessels naturally prevents a return of the blood into the circulation; consequently, special provision is made for the gathering up of these escaped blood elements in a special set of vessels called the *lymphatic system.* The fluid which flows in the lymphatic vessels is termed lymph. There are located along the vessels at certain points small bodies, called *lymphatic glands.* The vessels do not pass through these glands, but empty their contents into the glands, which are drained by vessels on the opposite side, so that the lymph is in reality passed along from one to another of a series of glands, until it finally reaches a point in the center of the body near the heart, where the various lymphatic vessels converge, and discharge their contents into large veins. At these points the blood pressure within the veins is practically nothing, so that there is no danger of a reflux of blood from the veins into the capillaries, which might occur if the connection between the lymph vessels and the veins were made at a point farther from the heart.

The lymph vessels are furnished with numerous valves which prevent a return movement of the blood. The wonderful wisdom displayed in the arrangement of the lymphatic system will be better understood after we have become acquainted with the character of the blood and its uses in the body.

The Battle in the Lymph Glands.

The lymph glands are constantly the scene of a fierce battle waged between the blood cells and the various enemies of life which are continually finding access to the body. The swelling of one or more of these glands, so often noticed in the neck and other parts where they are present in considerable numbers, is an evidence that a hotly contested battle of unusual character is being found. Germs which enter through the skin and find their way into the lymphatics cannot reach the deeper and vital parts of the body without running the gauntlet of many hundreds of these wonderful lymphatic glands, which act as filters, detaining the germs, and giving the white cells of the blood, which are always present in these parts in great numbers, an opportunity to destroy them. The lymphatic glands are placed in great numbers at those portions of the body where germs are particularly liable to enter. It is for this reason that they are so numerous about the neck.

How the Blood is Circulated.

Having studied the several paths through which the blood travels in the body, it is important to learn how it is made to travel along these several channels. Unquestionably the main impulse is given to the blood movement by the heart, which contracts with sufficient force to elevate the blood to a height of several feet in a tube connected with a main artery.

The total amount of work done by the heart in twenty-four hours in its contractions, in an average man, is about one hundred and twenty-four foot-tons; that is, it is equivalent to lifting one hundred and twenty-four tons one foot high, or lifting a one-hundred pound weight one foot high

2,480 times, or at the rate of about four times a minute for ten hours. By some authorities the amount of work done by the heart is estimated still higher than this, but even the expenditure of this amount of energy is not sufficient to maintain the movement of the blood current. Other forces are brought into operation which greatly assist in this important work. The movements of the body produced by contractions of the large muscles of the limbs and trunk, aid the circulation by compressing the veins, and thus forcing the blood forward, a return flow being prevented by the valves of the veins. The movements of respiration, as we shall also see later, produce a sort of suction action in the chest, which draws the blood in the lungs toward the heart.

The circulation is also aided to an important extent by the rhythmical contraction of the small arteries and capillaries, forcing the blood onward in a steady stream into the veins.

The circulation of the blood is thus operated by four forces, one which acts as a force pump at the starting point, the heart; a second which acts at the junction of the arteries and the veins; a third which operates by compressing the veins, the muscles; and still another, the chest, which acts as a suction pump at the return end. Man has constructed many ingenious pumping machines, but what human device can compare with this wonderfully simple and, at the same time, astonishingly powerful and efficient arrangement.

The Pulse.

The beating of the pulse goes steadily on from birth to death, without any interruption. How can this be possible if the heart is a muscle, and, like other muscles, requires rest? An explanation is to be found in the fact that the

heart takes a short rest at the end of every beat. A careful study of its action discloses the fact that it spends nearly half its time in resting.

The *rate* at which the heart works varies with many conditions. On counting the pulse at the wrist, the ordinary rate in an adult, sitting upright, is found to be 68. In the same person lying down the pulse rate will be found to be 64 beats, and in the standing position the rate would be increased to 78. Walking at a moderate rate usually raises the pulse to about 100, while by running and other violent muscular efforts, it may be increased to 180 or even more. The pulse rate of an infant is about 130 to 140; that of a child of ten years, 90. In aged persons the pulse is likewise found to be five to ten beats faster than in middle age. In fever the pulse rate is increased one fourth or more, and is sometimes doubled. The pulse is variously modified by disease, as shown by the accompanying pulse tracings obtained by an instrument known as the sphygmograph, a delicate mechanism by which the pulse is made to write its own record. The normal pulse rate, as is seen, gives regular, uniform curves. The long up stroke represents the contraction of the heart or the beat of the pulse. The accompanying illustrations show a tracing made by an intermittent pulse, and the tracing of an irregular pulse, such as is often met with in delirium tremens and critical cases of fever; also the irregular character of the tobacco-user's pulse.

The Regulation of the Blood Supply.

The blood supply of the body, in general, is regulated by the heart, but each particular part also requires regulation of the quantity of the blood supplied to it. This is effected by means of nerves similar to those which control the action

of the heart. Through the influence of these nerves, the muscular walls of the vessels are made to contract or dilate as may be necessary. If more blood is required, the vessels dilate, thus widening the channel and increasing the supply; if less blood, the vessels contract, thus diminishing the size of the channel through which the blood must flow. These nerves are brought into action when cold, heat, friction, or chemical irritants are applied to the skin. Cold causes contraction of the vessel walls, while heat, friction, and other irritants dilate them. The contraction from the effect of the cold, however, is quickly followed by a dilatation or so-called reaction. The dilatation produced by cold differs from that caused by heat, in that it is more permanent, and is accompanied by an active movement of the arteries whereby this increased amount of blood is pumped through the dilated vessels. Heat apparently dilates the veins more than the arteries, and does not increase the activity of the blood current through the skin. It is for this reason that heat gives to the skin a dusky red hue, while the reaction produced by a short application of cold produces a crimson red color. Prolonged cold produces a bluish color by so contracting the small vessels that the movement of blood through the skin is almost entirely suspended. The little blood that remains in the veins becomes so intensely charged with carbonic acid gas that it acquires a deep blue color, to which the color of the skin is due.

The Mystery of the Heart Beat.

It will be apparent that the regulation of the heart's action is a matter of the utmost importance; and the question must have already arisen in the reader's mind, How is this regulation effected? By what means is the heart made to go on beating rhythmically a whole lifetime, pumping just the

quantity of blood needed by the body at each particular moment, increasing its rate when called to support vigorous activity, slowing down at night to permit of sleep, never failing to respond to a call for blood made by the stomach, liver, muscles, or brain, which, with every organ, depend upon a constant and adequate blood supply to maintain their activity? This is one of the questions which physiologists have never been able to answer.

There are nerves passing out from the brain and spinal cord, the influence of which upon the heart is to increase its action. There are also other nerves which slow its action. These nerves seem to operate like the controlling levers of an electric car, one of which increases the speed of the car, while the other puts on the brakes and slows it down. Physiologists have found the levers by which the heart's action is controlled, but what about the power that operates the levers? On this point the scientist acknowledges his ignorance.

The heart is a muscle. A muscle is simply a living machine. It contracts only when it is commanded to do so. One may beat the table with his fist. The arm muscles contract and raise the hand, then bring it down with force; but the arm strikes only when it is ordered so to do. When no command is given, it remains passively inactive. The heart is only a muscle, and no more capable of activity independent of a will to command than is the arm. Each time that it contracts, it does so in obedience to a will behind it, of which it is the servant.

Let us make an experiment which will show this. Put the fingers of the right hand upon the left wrist, and find the beating artery there. It will be readily felt on the thumb side of the arm, at a point just above the bend of the wrist. You have found the artery. You feel it beating. Count the

number of beats per minute. The rate is seventy-two, we will say. Now command your heart to beat at the rate of eighty times a minute, or order it to stop for a few minutes. Notice, does it obey? Count again. There may possibly be a slight variation in the pulse rate, but certainly you are persuaded that your heart is in no wise subject to your will. You cannot command it to quicken or slow its rate, or if you do, your commands are not obeyed. Has the heart a will of its own? Is it a separate and distinct creature that can behave as it likes? Certainly this is not possible.

The Power Behind the Heart.

As a part of your body, the heart is an important department in the living temple. In its marvelous power, its ceaseless activity, the ready adaptation of its action to the changing needs of the body, it affords us a most convincing and indubitable evidence of the operation within our bodies of another will besides our own, of another intelligence, another consciousness, independent of our human or conscious intelligence, and going beyond it in its power to recognize and instantly supply our ever-changing needs. There is only one solution to this mystery. The power behind the heart, the hand which grasps the levers which control its ever-changing action, is the hand of Him who said, "I will strengthen thine heart." The intelligence which adapts its movements to every changing bodily need is that of Him who conceived and constructed this wonderful mechanism, who made the heart. The consciousness whose never-failing watchfulness maintains the activity of this throbbing engine of life while we sleep as well as while we are awake, is that of Him who said, "I am thy life," and whose actual presence and constant indwelling in every cell and every organ

of the human frame is essential to the performance of every bodily function, from the simplest to the most complicated, and to the maintenance of that marvelous harmony which secures the co-operation of each organ with every other one, and of each function with every other function, in the promotion of the activity and the well-being of our temple bodies.

THE BLOOD.

More than a century ago, a great English anatomist, John Hunter, performed an interesting experiment. He cut all the nerve trunks which supplied the limb of an animal, and then watched the result. The limb was paralyzed, but the flesh remained warm, the circulation continued, the part remained alive. The hair and nails grew as before. The muscles diminished for want of use, but life remained in every part, and with the exception of the inactivity, no evidence of disease appeared. Another experiment was then made in another limb. The arteries conveying the blood to the part were tied, while the nerves were left undisturbed. Note the different result. Within a few hours the limb became cold, it became livid, purple, and finally black. Soon the flesh began to fall away. The limb had died, and had become simply a decaying, putrescent mass.

The Life in the Blood.

John Hunter recognized from this experiment the great physiological fact proclaimed by inspiration thousands of years ago, as recorded in Genesis, and later repeatedly expressed and emphasized in Leviticus,—" the blood is the life." " For it is the life of all flesh; the blood of it is for

the life thereof." Lev. 17:14. "The life of the flesh is in the blood." Lev. 17:11. Recalling the declaration of Moses, who, in exhorting the children of Israel, declared of God, "He is thy life," we are brought squarely face to face with the fact that the Author of all life, the Creator of the blood, is himself present in this marvelous fluid which we are now about to study, and which we shall find surpassingly interesting as a marvelous evidence and illustration of the presence, within the temple, of its divine Author.

The Creative Power of the Blood.

John Hunter's experiment clearly showed that it is the blood which maintains the life of the tissues through which it flows. The creative power of the blood continually replenishes the worn-out cells and fibers, so that the body is constantly renewed. The eyes with which we look out upon the world to-day are not the same in substance as those which pictured for our brain the happenings of the outer world a year or two ago. The muscles which move us about, the brain and nerves with which we think and feel, are likewise new. All the soft parts of the body are so rapidly changed that the great mass of the body is probably renewed every few months, or every few years, at the longest. It is through the agency of the blood that this constant renewal of the tissues, this body rebuilding, recreating, is constantly carried forward.

The Healing Power of the Blood.

The same power which creates and maintains must also be the power that heals, for the healing process which is carried forward in the restoration of an injured part is in no way different in essence from that by means of which

the ordinary, every-day repairs of the body are effected. It is through the blood that the work is done. Wherever a part is injured, white cells accumulate in great numbers. They push themselves through the walls of the vessels, spread themselves over the surface of the wounded parts, and dexterously weave a new fabric to cement the ends of a broken bone, or to cover over a surface which has been denuded. In the formation of a new covering for a portion of the surface from which the skin has been removed, we have an ocular demonstration of the creating, healing power, which, through the agency of the blood, is being continually carried forward in the body.

It is, then, evident that in combating disease and injury of every sort, pure blood is of highest importance. Pure blood performs marvels and miracles of healing. Impure blood often fails entirely in its attempts to heal, because of the paralyzing influence of the poisons with which it is contaminated. This accounts for the fact, well known to surgeons, that butchers and beer-sellers are poor subjects for surgical operations. Wounds which appear to be trifling, and which in a man with pure blood would heal without difficulty, often become in such men desperately dangerous to life.

The Composition of the Blood.

The chemical and microscopical examination of the blood shows it to be composed chiefly of *water,* in which are dissolved the elements of the food which have been absorbed after having been transformed by the digestive processes and the liver, and certain very minute, round forms, termed *cells,* which we shall study further presently. There are found also in the blood small amounts of poisonous gases

and other poisonous substances, which, as we have previously learned, are being constantly formed in the tissues. As Bouchard, an eminent French physiologist, has well remarked, the body is "a factory of poisons." In every organ where activity is going on, poisons are being formed, just as smoke and ashes are being formed wherever a fire is burned, and for the same reason. Activity, whether of brain, muscle, or gland, results in the using of food and its conversion into poisonous substances.

A Circulating Market.

The digested food substances are taken into the blood, and by it carried to the waiting tissues in all parts of the body. The minutest little cell, the frailest filament of tissue, no matter how far removed from the great centers of life, receives its due share of nutriment through the medium of the blood, which has well been termed a "traveling market," or, perhaps more properly, a "traveling exchange;" for while the blood carries to each tissue material for the repairing of losses sustained in its work, for the building up of its structure, it takes in exchange for the new material which it supplies, the old, worn-out poisonous material, the waste, the rubbish of the tissues, thus securing a constant change of matter. This change is essential to life. In fact, the intensity of life depends upon the rapidity of the change. The more rapid the change of matter in the body through the medium of the blood, that is, the more rapidly old material is carried away, and new material deposited in its place, the higher the degree of vital activity, the more rapidly the wheels of life turn, the greater the amount of work done, the more one really lives. It may be said that the body is a living form, a mold, through

which a stream of matter flows. It is also interesting to note the fact that the increased rate of change does not hasten the wearing out of the body, but rather delays it, for deterioration of the temple structure takes place much more rapidly during diminished activity than when all the organs are in use, because of the stagnation and accumulation of the poisonous wastes which necessarily accompany slow tissue activity and change, and which interfere with the rebuilding of the tissues, and cause disease.

The Blood Cells.

It is only when a drop of blood is placed beneath a powerful microscope that one begins to comprehend the real character of this marvelous fluid tissue. Under the microscope the blood no longer appears red, but it seems to be filled with minute bodies of various shapes and sizes, known as the blood cells, or corpuscles. The number of these is so great that a very small drop contains more than five millions, while the number contained in the body of an average man amounts to the inconceivable number of thirty millions of millions. In other words, an adult man has in his body twenty thousand times as many individual blood cells as there are people on the face of the earth. The blood cells are so small that two thousand five hundred to three thousand five hundred or more are required to make a row an inch in length, yet their number is so great that they present a combined surface amounting to about thirty-two thousand square feet, more than two thirds of an acre, or more than one thousand six hundred times the area of the skin. The blood cells of a man, arranged in a single row, would reach six times around the earth.

Marvelous Creative Activity.

Each of these little cells is a distinct living creature. It has its own individual life; it grows, works, breathes, and feeds in the blood current as truly as does a fish in the water or a bird in the air. The life of a blood cell is only about six weeks. Pause a moment, reader, to consider the significance of this. Every six weeks every one of this vast multitude of minute living forms grows old, and dies, and must be replaced. In other words, thirty millions of millions of blood cells must be created anew every six weeks. This requires the making of blood cells at the rate of seven hundred thousand millions daily or about thirty thousand millions every hour, five hundred millions every minute, or more than eight millions per second. Think of it! At every tick of the clock eight million blood cells die, and eight million more are created to take their places. The number of living creatures whose dead bodies must be disposed of every second more than equals all the men, women, and children in the largest city on the globe, and in less than three minutes the number of dying and newly created cells more than equals the total population of the earth.

These facts are given for the purpose of getting clearly before our minds something of an idea of the marvelous creative work which is being continually carried forward in the body. In the presence of such an inconceivable creative activity, can we doubt the presence of an infinitely wise and beneficent Creator? These wonderful facts may perhaps enable us to enter into the inspired thought of the revelator when he exclaimed, "Great and marvelous are thy works, O Lord God Almighty." Rev. 15:3.

The Red Blood Cells.

A closer look at these wonderful blood cells reveals the fact that they are of many forms and sizes. The smaller ones are the most numerous. They have the shape of flattened, biconcave disks, and are of faint amber color. These are the oxygen-carriers of the blood. As they are swept along in the blood current to and fro between the lungs and the tissues, they transport in one direction from the lungs to the tissues the vitalizing, life-giving oxygen upon which every function of the body depends. Each corpuscle carries six times its own volume of oxygen. Just how the life-giving gas is captured by the corpuscle, and carried in the blood to the point where it is needed, human investigation has never yet explained. We only know the fact. The time occupied by the passage of the blood through the lungs is extremely brief, only a few seconds, and yet this is sufficient for the unloading of the poisonous carbonic acid gas which is received from the tissues, and the taking on of a load of oxygen. The lungs may be regarded as the chimney of the body,— the carbonic acid gas is the smoke, and the oxygen the air which comes in through the draught; thus the lungs serve the purpose of a draught, as well as that of a chimney. Suppose that a stove were constructed with but one small opening for the entrance of air or oxygen and the outlet of the smoke. The fire might be started in such a stove, but it would be quickly smothered by the accumulation of smoke, which would prevent the entrance of fresh air. The same thing would happen to the body were it not for the oxygen-carriers, the so-called red corpuscles. These carry in the fresh air, and carry out the smoke, just as men might carry into a laundry buckets of

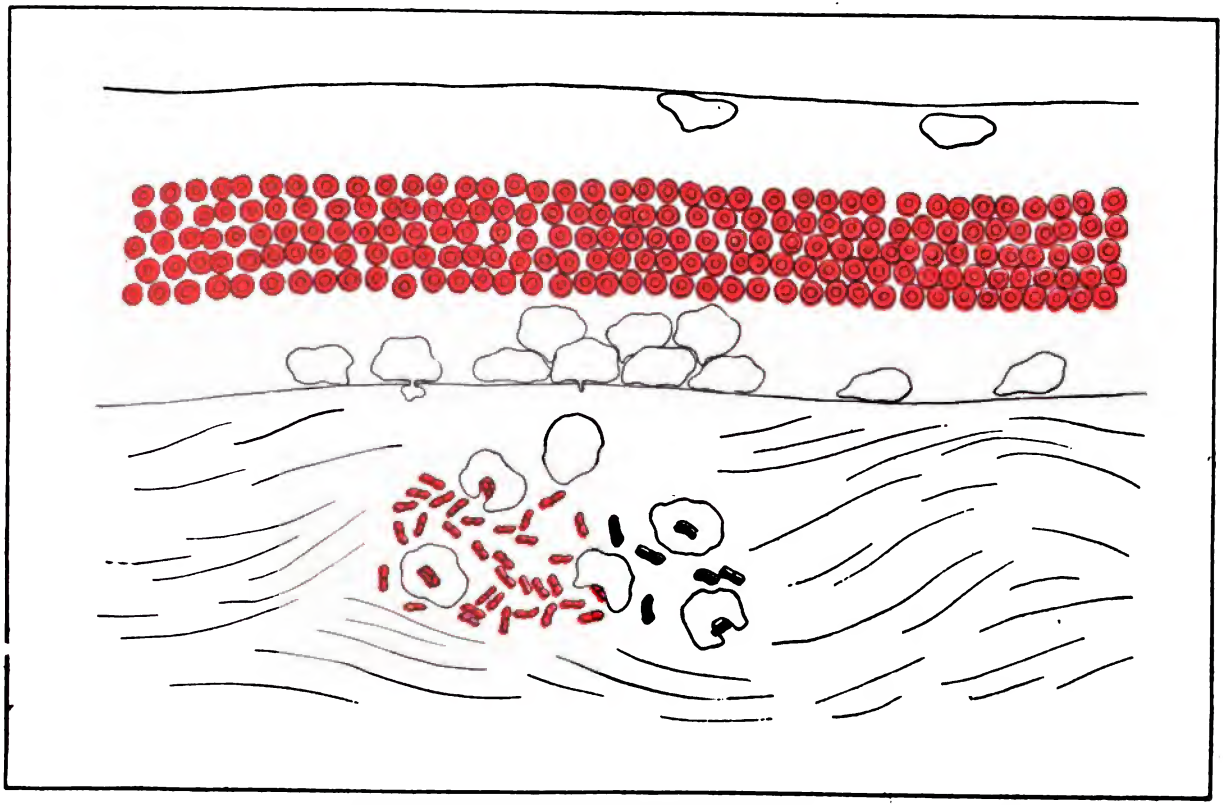
pure water and carry out the dirty water resulting from the washing processes.

The red corpuscles must not be looked upon as simply mechanical carriers like the little buckets of a chain pump or a grain elevator; they are living burden bearers, like the hod carriers who convey the brick and mortar for the construction of a building. They gather their load, and discharge it, not in a haphazard way, but precisely at the place where it is needed. But of course they cannot carry oxygen unless it is supplied to them, a fact which it is well for us to remember when we allow ourselves to sit in close, unventilated rooms, or when we carelessly take into our lungs infected or poison-laden air, which carries death instead of life, and embarrasses rather than facilitates the labors of these millions of tireless workers who are toiling in our behalf.

The White Blood Cells or Leucocytes.

The large blood cells present a very considerable variety in size and form, as will be seen by reference to the accompanying cut. In their natural state, the white cells are transparent, spherical forms, of the consistency of jelly drops, which float in the blood stream or creep along the inner surface of the vessel. Often they may be seen passing straight through the walls of the capillaries. Just how they accomplish this without leaving a gap behind them is another of the mysteries for which science has for many years in vain sought a solution.

These cells are almost constantly in motion, changing their forms continually, reaching out a process, called a "foot," first in one direction, then in another, stretching themselves



THE WHITE BLOOD CELLS COMBATING GERMS.

out in worm-like shapes, again gathering themselves together in smooth, round masses.

How the Blood Cells Combat Germs.

Each cell seems to have a will of its own, and to be possessed of a peculiar intelligence whereby it is unerringly led to the point where it is needed. Suppose, for example, a few germs are introduced into the tissues. If the experiment is made with some transparent tissue, as the web of a frog's foot or the wing of a bat, exactly what happens may be noted with a powerful microscope, and the revelation is truly astonishing. Watching closely, one may see the white cells beginning to accumulate on the wall of the blood vessel, just opposite where the germs have entered. The cells move more and more slowly, creeping carefully along, as though seeking the way, as one often sees a dog carefully tracking his master or game of some sort. By and by the moving mass of cells comes to a stop. Then each cell begins to push out a minute thread of its own tissue thrusting it through the wall of the vessel. Little by little, the farther end of the delicate filament which has been pushed through the wall grows larger and larger, while the portion of the cell within the vessel diminishes, and after a little time each cell is found outside the vessel, and yet no openings are left behind. The vessel wall remains as perfect as it was before. Apparently, each cell has made a minute opening, and has then tucked itself through, as one might tuck a pocket handkerchief through a ring, deftly closing up behind itself the opening made.

Once outside the vessel, these wonderful body defenders, moving here and there, quickly discover the germs, and proceed at once to swallow them. If the germs are few in

number, they may be in this way destroyed, for the white cells not only swallow germs, but digest them. If the number is very great, however, the cells sacrifice themselves in the effort to destroy the germs, taking in a larger number than they are able to digest and destroy. When this occurs, the germs continue to grow; more white cells make their way out of the blood vessels, and a fierce and often long-continued battle is waged between the living blood cells and the invading germs.

"God Manifest in the Flesh."

Some secret influence, which the scientists cannot understand and do not undertake to explain brings the white cells hastening to the scene of the conflict from all parts of the body, until the number accumulated may be so great as to greatly distend the parts. It is in this way that a boil, or an abscess, is formed, and the so-called pus which is discharged consists of these white blood cells which have left the blood and have laid down their lives in the defense of the body. The number of these cells which may be sacrificed in such a battle, when it is waged day after day, as in prolonged suppuration, may be appreciated when the fact is stated that a single ounce of pus may contain as many as 150,000,000,000 of these fighting cells which have died in their efforts to repel the invading germs. This immense number may be better appreciated, perhaps, if we consider that if the cells were placed close together in a row, the line would be 1,000 miles in length.

From the above facts it is clearly evident that these minute specks of life which we call the white blood cells, are each controlled by an intelligence which directs every movement with precision and accuracy toward the accomplishment of

some beneficent purpose. Here is a marvelous manifestation of the divine Intelligence which thinks and wills within the body, quite independent of the human will and outside the human consciousness, an Intelligence which, in its infinite solicitude for the welfare of the human body, supervises the movements and activities of every individual cell. Here, as everywhere in the wide domain of life, we find the voice of nature speaking to us in the words of the ancient Seer, "Be hold your God."

The white cells probably constitute one of the most important of all the defenses of the body. They keep the blood channel free from germs and minute particles of all sorts. There are facts which seem to indicate that, after capturing the germs which enter the circulation, they transport them to the spleen, which thus serves as a sort of police station and headquarters for these body guards which are continuously moving up and down the ways of the body, arresting and destroying invaders, and conveying them to a place where they can do no harm. There are various sorts of white cells, each of which probably has its own special work to do, but this is a question concerning which very little is yet known.

How the White Cells Destroy Malarial Germs.

With the microscope one may see the blood cells of a person sick with malaria, attacked by minute animal organisms, which, developing within the body, produce poisonous substances, which give rise to chills and fever. These parasites feed upon the red cells, sometimes destroying them with immense rapidity. The white cells, if present in sufficient numbers, are able to capture and destroy the malarial parasites before they have done their work of mischief, thus

preventing the usual consequences of exposure to malarial infection. It is thus clear that it is of the highest importance that one's white cells should be in good fighting condition that they may have the power to resist and destroy the germs which enter the blood in various ways.

Recent investigation has shown that the bite of a single mosquito is sufficient to produce a virulent and even a fatal attack of malarial or of yellow fever. This can be true, however, only in persons whose white cells have been so injured that they are not able to defend the body with their usual activity and success. We owe our protection or recovery from infectious diseases of all sorts chiefly to the activity of these wonderful organisms. A little later we shall consider some of the means by which the activity of the white cells is lessened, and the ability to defend the body destroyed.

The Blood Serum.

The serum, or fluid portion of the blood in which the corpuscles float, and in which the nutritive elements absorbed from the food are dissolved, is alkaline, when the blood is in a naturally pure state. This alkaline condition is necessary for the maintenance of the activity of the blood cells and the tissues which are bathed by the blood. The absorption of waste substances from the tissues and of the acids formed by fermentations from the stomach and intestines lessens this alkalinity. It is also lessened by sedentary habits, by neglect to take proper exercise, by impure air, by the use of alcohol, excessive quantities of sugar, and by various diseases, as fever and rheumatism, especially the latter disease. Certain articles of food, especially meat, which contains a large amount of uric acid, may lessen the alkalinity of the blood. This is a

matter of great importance, for the reason that the serum, like the cells, when in a state of health has the power to destroy germs; but when its alkalinity is diminished by the causes above mentioned, this power is to a large extent lost, and as the result, the power of the body to defend itself against infection with germs is materially lessened. This is one of the reasons why persons suffering from indigestion are more liable to contract typhoid fever, cholera, and other germ diseases, than are those who have sound stomachs.

Pure and Impure Blood.

The popular notion that the prompt healing of a cut or other wound is an evidence of purity of blood, has a sound scientific basis. When the skin is broken, germs in large or small numbers are thereby admitted to the sacred precints of the tissues from which they are ordinarily excluded by the dense structures of the skin. When the tissues are maintained in a healthy state by pure and vigorous blood, the few germs which enter are quickly destroyed, so that the formation of pus, or so-called suppuration, does not occur; but when the blood is not pure, so that the serum and the cells are not able to make the necessary active defense, the germs grow and develop, suppuration occurs, and the wound, if a large one, may require a very long time to heal.

What is true with reference to wounds is true of all the maladies which depend upon the entrance of germs within the body. Hence it is of the highest importance that the blood should be maintained in the highest state of purity. Let us notice some of those causes which are well known to produce impure blood, remembering that this is a question of the highest importance to very human being, for

since the blood is the life, weakened blood means weakened life, impure blood means a contaminated and infected body.

As an eminent French physiologist once remarked, "All life is under water." The cells of the body are bathed in the blood, or at least in the fluid which drains out from the blood vessels, the lymph or the serum. If the blood is impure, every cell, every fiber of the body, is bathed by an impure fluid, and must be more or less injured thereby.

Picture in your mind a glass globe filled with water and fishes and other small creatures swimming about in it. Now imagine that indigo, ink, or coloring matter of some other sort, is dropped into the water. It will immediately become tinged, and if the coloring matter is of a poisonous character, the fishes will soon show uneasiness, and unless relieved by a replacement of the impure water by a fresh supply, will soon die. This is just the condition of the living cells of the body when bathed in impure blood; the stomach cells which secrete the gastric juice, the muscle cells which contract, the liver cells which make bile, the brain cells which think,— every one is definitely and seriously injured by the impurities brought in contact with it. Impure blood, then, must be regarded as the foundation of a large proportion of all the diseases from which human beings suffer. It is highly important that we be well informed respecting the causes of blood impurity.

The Relation of Food to Blood Purity.

In this list we must include all foods which themselves contain poisons, or unwholesome substances which may be absorbed into the blood, such as alcoholic beverages of every description, including home-made wine, cider, beer, ale, small beer, and the various sorts of family bitters which

always contain a considerable amount of alcohol. Condiments, such as pepper, mustard, pepper sauce, ginger, and like substances, must also be regarded as poisons and sources of contamination. Flesh meats of every sort contain, as we have seen, impurities in very large amount, being saturated with venous blood and tissue poisons. Animal products and extracts and meat juice are not concentrated nutriments, as commonly supposed, but rather concentrated tissue poisons, which, when taken, render the blood impure, and diminish its alkalinity. Meat which has undergone decomposition, that is, which has become tender and high-flavored by long keeping after killing of the animal, cheese, sauerkraut, and all foods which have undergone fermentation or decomposition, are sources of blood contamination, and must be discarded.

Overeating renders the blood impure by filling it with unused and imperfectly prepared material which must be treated as so much waste matter. Overwork and deficient sleep fill the blood with impurities, and lessen its alkalinity by the overproduction and deficient elimination of the tissue wastes or poisons which naturally form in large quantities whenever the body is at work.

Blood Poisoning by Alcohol and Other Drugs.

Drugs of various sorts, such as opium, tobacco, and many other narcotic drugs, contaminate the blood, and lessen its defensive power. Exhausting indulgences of all sorts have a similar effect.

Tobacco and alcohol not only contaminate the blood, but produce diseases of the heart and blood vessels. The tobacco heart is becoming exceedingly common among young men as a result of cigarette smoking. A large pro-

portion of those who volunteer for military service are rejected because they are found to have tobacco heart. Alcohol produces deterioration of the muscles of the heart and blood vessels, finally resulting in a disease commonly known as arteriosclerosis, or hardening of the arterial walls, thus producing premature old age.

The Skin and the Blood.

Neglect to maintain the proper activity of the skin, kidneys, bowels, and lungs leaves poisonous matters to accumulate in the blood. If the lungs are not rendered active by proper exercise, the amount of oxygen taken into the blood will be deficient, and the accumulating wastes will not be burned, or oxidized, and consequently will be deposited in the skin and other tissues, producing a dingy sclerotic, or muddy complexion, and other evidences of blood contamination. By exercise, the amount of air taken into the lungs may be increased sevenfold, and blood purification may be proportionately increased. Neglect to keep the skin active by sweating baths, or better still, perspiration induced by exercise, and daily cold bathing, prevents the elimination of the poisons which naturally pass off through this channel. When the bowels are allowed to become constipated, the poisonous matters which are retained are absorbed into the blood, and become a source of universal disturbance and injury throughout the body. If a sufficient amount of water is not taken to dilute the blood, wash the tissues, and encourage the kidneys in removing the acid poisons which it is its particular duty to separate from the blood, these highly injurious substances are retained, giving rise to rheumatism, gout, headache, and many other maladies. Vigorous exercise out of doors is one of the most important means of maintaining blood purity.

The idea that the blood may be purified by medicine of any sort is a very great error, and one which has been productive of a vast deal of mischief. There are no herbs or drugs of any sort the taking of which will purify the blood. The blood is not to be purified by putting something into it, but requires that something be removed from it. Water is the universal cleansing agent, and its free use is essential to blood purification. To undertake to purify the blood by means of pills is about as reasonable as to undertake to launder a dirty shirt or any other soiled garment by the same means.

Blood Building.

The blood must be enriched by an ample supply of pure food elements, as well as purified by the removal of waste materials and the exclusion of unwholesome material. Nothing could be further from the truth than the very generally entertained notion that the blood must be fed by blood; in other words, that the quickest and most certain means of enriching the blood is by the taking of the blood of some animal, either in the fresh state or in the prepared form in which it is presented in various well-known medicines. There is no foundation whatever for this idea. Animal blood differs from human blood as much as animal intelligence differs from human intelligence. Even when the warm, fresh blood of an animal is injected directly into the veins of a human being, the blood cells thus introduced quickly disappear, being somehow destroyed in the body as unusable. They are recognized as strangers, as invaders which cannot be tolerated, and within a few hours after they are introduced, even though the quantity may be very large, not one can be found. When taken into the stomach, blood

must pass through the same processes of digestion as does ordinary food, to which it is rendered decidedly inferior by the fact that its nutrient value is low, while it contains a large proportion of the poisonous elements which the body is continually exerting itself to exclude.

Blood-Building Foods.

For the making of pure blood the first essential is pure food, and not blood or blood-containing food. If the blood has been greatly reduced in quantity, it is important to take food rich in proteids. These are furnished in abundance by many of the natural foods which Heaven has prepared for man's use. Among the choicest of these are nuts, especially almonds, peanuts, Turkish hazelnuts, or filberts, pecans, and all nuts from which the outer shells and skins can be readily removed. A pound of nuts contains more blood-forming material than a pound and a half of the very choicest (so-called) beefsteak. Peas, beans, and lentils are also splendid blood formers, containing more than one fourth their weight of blood-making material, and each pound equal in food value to three pounds of beef.

Whole-meal bread and gluten preparations of all sorts are also good blood-making foods. All foods which hinder digestion, and which give rise to fermentation or other disturbances, must be carefully avoided, as the acids formed by the souring of the foods serves to lessen the alkalinity of the blood, and thus to deteriorate its quality. This is not true of the acids found in fruits. These are food substances, and unless taken in very great excess are in no wise harmful, but on the other hand are highly beneficial. These acid fruits encourage the action of the kidneys, and thus aid in the removal of poison, while they at the same time disinfect

the stomach and intestines, and thus prevent the formation of poisons by fermentative and putrefactive processes.

How Cold Baths Improve the Blood.

A few years ago the remarkable discovery was made by Professor Winternitz, of Vienna, that general cold baths have the effect to increase the number of active cells in the blood to a very remarkable extent, the increase sometimes amounting to one-fifth or even more. The author has repeated these experiments, and has found the results to be as indicated. The white corpuscles are increased to a much larger extent than the red cells, sometimes being nearly doubled. The increase is observed within half an hour after a general cold bath, when reaction has taken place. It must not be supposed, however, that the cells added to the blood are actually formed in this short time. There is little doubt that the increase in the number of cells which may be counted in the blood is due to the fact that cells which have been held idle in some deeply seated part are brought out into the active circulation by means of the bath, and thus made useful. The effect, however, is practically the same as though new cells had been formed. This is one of the ways in which the cold bath increases the resisting power of the body, and rallies the blood cells, so to speak, calling them out from their hiding places, and preparing them to fight with vigor the battles which must be waged every moment in defense of the body.

How to Strengthen the Heart.

In order that the blood may properly perform its work, it is not only necessary that it should be rich in food elements and free from impure substances, but it must also be

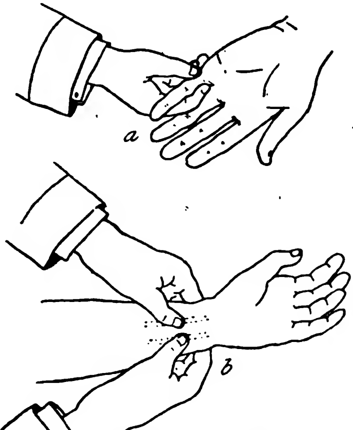
circulated properly by vigorous heart action. The heart is rendered strong by exercise, just as is any other muscle. The heart of an idle or sedentary man is always weak. This is one of the chief reasons why such men quickly get out of breath when called upon to make some unusual exertion. The same exercise which strengthens the legs in running, or the arms in rowing, strengthens the heart also by compelling it to do the amount of work necessary to supply the needed blood to the active muscles, and to carry it to the lungs for purification. Persons, however, who have weak hearts must avoid violent exercise, but should put themselves under careful training, beginning with general exercises, and gradually increasing the vigor of the muscular work from day to day. Care should be taken to avoid getting greatly out of breath, or exciting the heart to such a degree as to produce a very rapid pulse. If some shortness of breath is induced by the exercise, it should subside on resting within four or five minutes. The pulse also should return within a few minutes to its normal rate. Walking, and especially mountain climbing, is a most excellent means of strengthening the heart, if not excessively weak. If, however, the heart is so weak as to cause swelling of the ankles, one of the indications of a very weak heart, mountain climbing is too severe a form of exercise. Even walking may be necessarily prohibited in some cases. Still more gentle exercise must be employed, but in such cases the individual should place himself under the care of a physician who is thoroughly acquainted with the application of physiological therapeutics.

THE SPHYGMOGRAPH.

NORMAL PULSE.

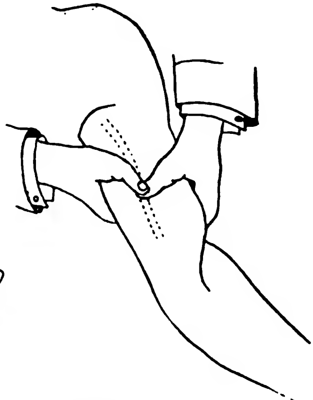
IRREGULAR PULSE.

A SMOKER'S PULSE.

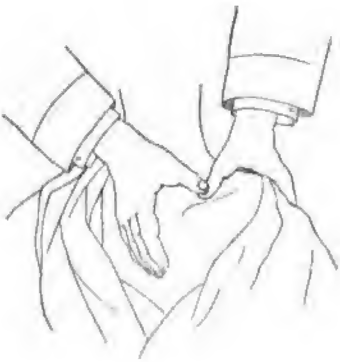


a COMPRESSING ARTERIES OF THE FINGER.

b COMPRESSING ARTERIES OF THE WRIST.



COMPRESSING MAIN ARTERY OF THE ARM



COMPRESSING THE ARTERY OF THE ARM IN THE NECK.

COMPRESSING THE MAIN ARTERY OF THE LEG

WHAT TO DO IN CASE OF SUDDEN ILLNESS OR ACCIDENT.

Fainting. — When a person faints, it is because of weakness of the heart. This may be due to various causes, such as impure air, tight lacing, sudden fright or other nervous disturbances, or simple exhaustion from overexertion. A person generally begins to feel "faint" a short time before he loses consciousness. If at this time he will immediately lie down, or if he is sitting, bend forward until his head is at or below the level of the knees, the symptoms will generally disappear within a few seconds, or a minute or two at the most. A sip of cold water, or bathing the face with cold water, will also generally prevent a threatened fainting.

If the person has actually fainted away, he should quickly be placed in a horizontal position, laying the head as low as possible. While cold water is being brought, slap the face with the hand quite vigorously, though not so hard as to bruise the tissues. A few smart strokes over the region of the heart are also likely to prove helpful. The best remedy is to sprinkle cold water upon the face. The application may be made by dipping the fingers in cold water and shaking them vigorously over the face, or by wetting the end of a towel and slapping the face with it. A fainting person is in a very dangerous condition, and should be relieved as quickly as possible. In serious cases the person who has fainted must be kept in a horizontal position for some time, several hours, or in some cases several days. If on rising the fainting sensation recurs, a physician should be consulted. The tendency to faint may be overcome by the daily cold bath. The cold mitten friction and the cold

towel rub are particularly well adapted to cases of this sort. Extremes of temperature, very hot baths, and very cold baths, should be avoided by persons who faint easily.

Hemorrhage. — The blood spurts from a wounded artery. The blood flows in a steady stream from a wounded vein. Venous blood is also darker in color than arterial blood. To stop the flow of blood from a wounded artery, pressure should be made on the side of the wound toward the heart. It is not always best to make the pressure directly upon the wound. The pressure should be made instead upon some point above the wound where the arterial trunk comes near the surface, and where it can be brought between the thumb or fingers and the bone, so that it can be influenced by firm pressure. The accompanying cuts show the points at which pressure should be made to control hemorrhage in different parts of the body. It is well to practice compression of the arteries at these several points so that one may be prepared to act quickly when occasion requires. If the part injured is a limb, it should be raised at once as high as possible. and compression should be made upon the bleeding point, care being taken that the compressing fingers are clean; or the wounded part may be protected by a little pad formed of clean muslin, placed over the part. Moistening the pad with lemon juice aids in controlling hemorrhage, by causing contraction of the blood vessels. This alone will often control a slight hemorrhage. If the bleeding does not cease, and compression cannot be applied or continued until a physician can be procured, more permanent compression may be applied by means of a little pad consisting of cloth or paper rolled up and placed over the artery, and compressed by means of a band placed about the limb or over the body, then twisted until sufficiently tight to control the bleeding. The greatest dis-

patch must be used, as a large and often fatal amount of blood may be lost in a short space of time if the vessels are of considerable size.

Hemorrhage from the Nose. — Reaching both hands high over head, bathing the face with very hot water, placing bits of ice in the nostrils, rubbing ice on the back of the neck, and compressing the nose frequently between the thumb and finger for several minutes, are useful measures in checking nasal hemorrhage. Care should be taken to hold the head erect. Bathing the face with cold water while bending the head forward over a wash basin often increases the bleeding.

Bleeding of the Gums, following extraction of the teeth, may be checked by placing a bit of ice upon the bleeding point, or making a little wad of cotton or muslin, saturating this with lemon juice, and holding it upon the affected part by closing the teeth upon it.

Hemorrhage of the Lungs is a very serious and sometimes a fatal accident. Bleeding from the lungs, however, is not so dangerous as is supposed, as it is very seldom that the bleeding continues long enough to produce fatal results. When the patient becomes faint, the heart's action decreases to such a degree that the bleeding ceases in most cases. Ice to the front of the chest, short, very hot fomentations to the back of the chest, hot to the feet and legs, and ice in the hands, are the most effective means of checking hemorrhage from the lungs.

Hemorrhage from the Stomach can usually be controlled by absolute rest in bed and the withdrawal of food. In some cases the patient should not be allowed to drink so long as there is a tendency to hemorrhage. There is usually pain in connection with gastric hemorrhage, because of ulceration of

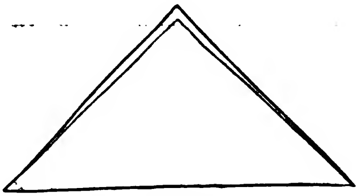
the stomach. So long as there is pain in the stomach, no food should be given, and in many cases drink also should be withheld. The patient should be nourished with nutritive enemas. Ice over the stomach, in most cases ice to the back, opposite the stomach, and in most cases an enema every two hours are effective.

Hemorrhage from the Bowels. — The patient should be required to remain closely in bed. Apply hot to the legs, and two or three ice bags to the bowels. Two or three pints of ice water may be injected into the rectum.

Sunstroke. — Remove the patient to the shade at once. Remove the clothing, apply cold to the head, and pour cold water upon the body from a height of several feet, or as high as possible. The patient should be vigorously rubbed by two persons at the same time that the cold water is being applied, so as to insure thorough and prompt reaction. Very few lives will be lost by sunstroke when this measure is promptly and efficiently applied.

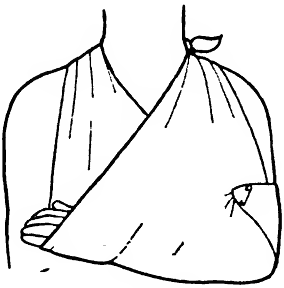
Insect Stings. — Apply compresses wet with soda, or a soap poultice. In case the patient has been stung several times, as when attacked by a swarm of bees, administer a considerable quantity of hot water, both by the stomach and by the rectum. Make the patients drink two or three pints of hot water or hot, weak lemonade as quickly as possible. A sweating bath, especially an electric-light bath, followed by a vigorous cold bath, will be helpful. The swollen parts may be fomented every three or four hours for four or five minutes, and during the intervals between the fomentations, covered with cloths wet in soda, two drams to the pint.

A Bruise is best relieved by a hot fomentation applied as soon as possible after the accident, and repeated at intervals

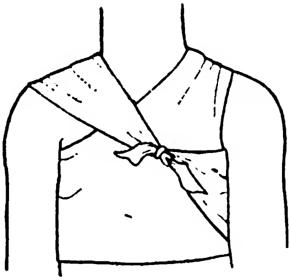


TRIANGULAR BANDAGE.

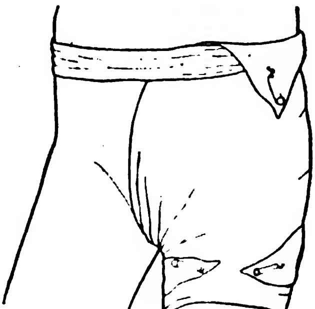
HEAD BANDAGE



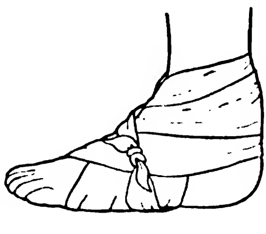
THE SLING.



THE CHEST BANDAGE.



HIP BANDAGE



FOOT BANDAGE.

THE VENUS DE MILO.

A FASHION DEFORMED WOMAN.

of two or three hours, as long as the bruise remains sore and painful. During the interval apply a compress consisting of a towel wrung as dry as possible from cold water, applied over the part, and covered first with oilcloth, and then with several thicknesses of flannel, to maintain warmth. Gentle manipulation of the surrounding parts will serve to maintain good circulation, and so prevent discoloration in many cases.

Burns may be successfully treated in various ways. If the skin has not been removed, apply cloths wet in a saturated solution of picric acid. The effect will be a hardening of the skin, which becomes a sort of protection for the injured parts. Care should be taken to avoid removing the skin, even although it may be easily detached.

When the skin is destroyed, the part must be carefully covered with some emollient by which it will be protected from the air. White vaseline is good for the purpose. White of egg, baked flour, or cornstarch and various simple domestic emollients are good. When powders are used, they must be kept moist, so as to avoid irritation of the injured tissues by contact with the air. Cloths wrung out of cold water is an excelent means of relieving pain. The cloths should be removed as soon as they become slightly warm. They should cover the whole burned surface.

Wounds.—A clean wound, inflicted by a sharp knife, generally heals very quickly, unless some large artery or internal part has been injured. An infected wound, however, may lead to general infection or diffuse suppuration, and most unhappy results.

The Dressing of Wounds.—Care should be taken to check the bleeding if this is considerable, then the parts should be carefully cleansed with hot, strong soapsuds. Soap is an efficient disinfectant. Green soap is excellent for the purpose.

After the cleansing, a sterilized dressing should be applied. Cheesecloth is the most satisfactory material. It should be boiled, dried, or baked in an oven at a temperature of three hundred degrees, until slightly browned, to prepare it for the aseptic dressing of wounds. Such cotton should be on hand, ready for use, in every household. It may be readily preserved by keeping in a glass jar. An ordinary fruit jar is suitable for the purpose. After cleansing the wound, apply the antiseptic dressing, which may be held in place by a suitable bandage.

Sprains require prompt and thorough attention. They sometimes give rise to permanent injury. Soak the affected part in hot water for twenty to thirty minutes. The water should be maintained at as high a temperature as possible by the addition of very hot water at frequent intervals. The duration of a hot foot bath should be ten to twenty minutes, after which an elastic bandage should be applied to the affected joint in such a way as to prevent swelling on the outside of the bandage. The foot should be elevated for a few hours, until the tendency to inflammation has subsided. After the first twenty-four hours, very gentle rubbing of the limb may be employed. The rubbing movement should be in a direction from the injured part, toward the heart. Hot bathing or a hot fomentation should be administered two or three times daily, and the heating compress should be worn between.

The fomentation is an excellent means of increasing local circulation. In certain cases cold applications are also useful. As a rule, however, the fomentation or the hot compress, followed by the heating compress, is preferable. The fomentation may be applied three or four times a day. The heating compress should be changed each time the fomentation is employed.

The Breath of Life.

EVERY living thing breathes. The smallest insect as well as the largest animal requires breath. Plants breathe by means of their leaves and bark. Fishes breathe by means of their gills. Some other humble creatures, as the earthworm, for example, have no other breathing organs than the skin with which their bodies are covered.

Breathing is the receiving of air into the body, or rather the absorption of oxygen. In man and the higher animals this is accomplished by means of a most ingenious pumping device, by which the air is sucked in through the nose and the mouth. This breathing apparatus consists of the *chest,* the outer walls of which are made up chiefly of ribs and muscles; the *diaphragm,* which forms the floor of the chest cavity; and the lungs and the breathing tubes which are placed within the cavity. The lungs are a double, hollow sack, which is subdivided into an immense number of smaller sacks, or air cells, in the lining membrane of which is found an extremely rich capillary network, to which is distributed for purification the blood sent to the lungs from the heart. The lungs are covered by the protecting *pleura.* A similar membrane lines the chest. Air is conveyed into the lungs through the *larynx, trachea,* and *bronchial tubes* which are connected with the back part of the mouth.

The great importance of the breath is recognized by many expressions in Holy Writ. The breath is especially recognized as the source of life to the body. It is often employed as an emblem of power. "Thou takest away their

breath; they die." Ps. 104:29. "As the body without breath [margin], so faith without works is dead also." James 2:26. It is as much the duty of every enlightened person to give thought to the quality of the air he breathes, and to the manner of breathing, as to give attention to the food he eats, and the manner in which it is served and eaten. Pure air may indeed be regarded as one of our most necessary foods. In fact, death occurs more quickly when the body is deprived of air than when deprived of other food or of water.

Here we have another evidence of the beneficent activity of a divine intelligence in the body, protecting it from danger, maintaining its powers in the highest degree of activity so long as man himself co-operates by obeying those laws which are essential to his physical well-being. If man suffers from the inroads of germs, it is not an arbitrary affliction of Providence; it is not because God is unmindful of him and willing that he should suffer, but because by his own acts he has broken down the wall of defense which God has built about his body temple, and has thus by his own will opened the temple door to admit the destroyer. Here is a text for a whole chapter upon the moral obligation of hygienic and sanitary duties, but the limitations of space forbid us to dwell upon this interesting point longer than to indicate the principle, the broad applications of which, in various lines, the reader will do well to follow out.

Proper Breathing.

Air is made to enter the chest by enlarging the chest cavity, or thorax. This is accomplished by a downward movement of the diaphragm and an outward movement in all directions of the lateral chest walls. This is largely

accomplished by the muscles which lift the ribs and pull them outward from the center of the body. The lungs are emptied by the natural return of the parts to a passive state, when the muscles cease their pulling upon the chest walls. In ordinary deep respiration, when the breathing movements are not interfered with, the movement consist chiefly of an enlargement of the trunk in the region of the waist. There is at the same time a marked bulging forward of the abdominal wall. This style of breathing is sometimes, though incorrectly, termed abdominal respiration. In abdominal respiration proper there is a forward movement of the abdomen, but without marked enlarging of the waist. Abdominal respiration is most frequently seen in sedentary men and in infants. The opposite style of breathing, known as costal breathing, is seen in women who habitually wear waist-constricting garments. The principal movement is at the top of the chest.

Neither costal nor abdominal respiration is capable of bringing the lungs fully into action. Only such portions of the lungs act as lie in contact with a portion of the chest wall which moves during the respiratory effort, and in those parts which lie in contact with portions of the chest wall which remain idle, the air stagnates. Carbonic acid gas and other poisonous matters accumulate. The living cells are thereby poisoned and paralyzed. Pneumonia germs and other disease-producing microbes, and especially the germs of tuberculosis, are likely to find lodgment in these idle parts. The paralyzed cells are easily overcome by the invading germs, and so an acute inflammation may be set up, or, still worse, that dreadful disease, pulmonary tuberculosis, or consumption, obtains a foothold.

The Use of the Abdominal Muscles in Breathing.

It is important to cultivate a proper mode of breathing, taking pains to expand the lower part of the chest. One does not use the abdominal muscles actively in ordinary respiration, but they are used passively in aiding respiration. As the breath is drawn in when the full chest is expanded, especially the lower part, the abdominal muscles are stretched. The diaphragm, in descending, presses the abdominal organs outward, thus rendering tense the muscles which form the front wall of the abdomen. In expiration, the muscles contract, as does rubber when released after stretching, and by the pushing of the abdominal organs upward, aid in crowding the air out of the chest and preparing for another incoming breath. In order to serve this useful purpose, the abdominal muscles must be strong and tense. Flaccid muscles can render no service. In forcible respiration, as in speaking, the abdominal muscles, as well as the muscles of the chest, must be kept under constant control, sometimes being contracted with vigor to give increased force to the voice. This action is especially necessary in public speaking and singing.

In speaking, one should breathe deep enough to feel distinctly the movements of the abdominal muscles. By this means greater volume will be given to the voice, the effort of speaking will be found much less laborious, and the voice will be much less easily fatigued. A high-pitched, strained voice should be particularly avoided as highly irritating to the throat, exhausting to the speaker, and disagreeable to the audience.

Persons who have not learned the use of the abdominal muscles in speaking or in singing, or in whom they are so weak as to be of no service, habitually use the muscles of

the throat and upper part of the chest in a strained way during loud speaking or singing, and greatly to their injury. Not only the voice suffers but the habit of using the lungs in this way impairs digestion, the action of the liver and the functions of all the abdominal organs, which need the benefit of the rhythmical movement produced by the strong action of the lower portion of the chest. This is the real secret of the great benefit experienced by many who have corrected their mode of breathing, transferring the principal action from the upper to the lower part of the chest. It should be remembered, however, that the whole chest should be moved, and the upper part of the chest fully expanded, in order to secure proper ventilation of every part of the lungs, thus preventing the lodgment and development of germs and the various acute and chronic diseases which result therefrom.

The Normal Type of Respiration in Men and Women.

The idea that women naturally breathe with the upper part of the chest, while men breathe abdominally, has very little, if any, foundation in fact. The author took pains a number of years ago to make a careful study of this subject among the most primitive Indian tribes of the United States. He also made careful observations of Chinese women, and has since had opportunity for similar study of the breathing movements of Mexican, Egyptian, and Arab women, as well as those of other nationalities, whose clothing has never been such as to interfere with the normal breathing movements. In such persons, the type of breathing has been found to be in women precisely the same as in men, namely, an expansion of the whole chest. The movement is naturally less at the upper part than at the lower part, for the reason

that the ribs which form the framework of this portion of the chest wall are shorter and more firmly held in position, while the lower ribs are supplied with long, flexible cartilages, which readily yield under the pulling action of the muscles of respiration.

The normal rate of respiration is sixteen to eighteen times a minute, or about one breath for every four heart beats. The rate of respiration differs greatly in different animals. The hippopotamus, for example, breathes but once a minute, while the sparrow breathes ninety times a minute, and the rat two hundred times in the same period. The ox, the dog, and the horse breathe at about the same rate as man.

The amount of air which passes out and in the lungs during respiration is about twenty-five cubic inches. This represents, however, but a small part of the actual capacity of the lungs. The average man is able to take into the lungs, after an ordinary inspiration, one hundred or more cubic inches, and to force out of the lungs after an ordinary expiration an equal amount. There is still left in the lungs, after as much air as possible has been forced out of them, about one hundred cubic inches, making the total lung capacity of the average man about three hundred and twenty-five cubic inches, or nearly one and a half gallons.

The Two Breaths.

The purpose of breathing is to obtain from the air a supply of oxygen, which the blood takes up and carries to the tissues. Oxygen is one of the most essential of all the materials required for the support of life. Its function in the body is to set free or to bring into action the energy stored in the tissues in the form of digested and assimilated

food. We have previously learned that this energy is originally derived from the sun, that it is in fact sunlight. The purpose of the oxygen, then, is simply to set free the sunlight which has been captured by the plants, organized into food, and appropriated by the body, and it is the real source of life and energy in the body. The amount of oxygen necessarily required for this purpose is about one and one-fourth cubic inches for each breath. As the blood passes through the lungs, this amount is absorbed when the breathing movements are sufficiently deep and active, and the air inhaled is of good quality. In place of the one and one-fourth cubic inches of oxygen taken into the blood, a cubic inch of carbonic acid gas is given off, and along with it are thrown off various other still more poisonous substances which find a natural exit through the lungs. The amount of these combined poisons thrown off with a single breath is sufficient to contaminate and render unfit to breathe three cubic feet, or three fourths of a barrel, of air. Counting an average of twenty breaths a minute for children and adults, the amount of air contaminated, per minute, would be three times twenty, or sixty cubic feet, or one cubic foot a second.

Here is an important fact which may be easily remembered, and made of practical use as a means of determining the amount of fresh air required for a family or the ventilation of a schoolroom or a church. The importance of a constant supply of fresh air may be readily illustrated by simply holding the breath. Very few persons have sufficient resolution to stop breathing for two or three minutes, though experienced divers are sometimes able to hold their breath for a somewhat longer time. The breathlessness which results from a few moments' active exercise is due to the urgent demand of the tissues for oxygen.

Why Ventilation Is Required.

It is not, however, the need of oxygen which renders important a constant and adequate supply of air by means of ventilation. Ventilation is needed chiefly for the purpose of washing away the impurities which have been thrown off from the lungs, and which have rendered the air of the occupied apartment unfit for further breathing. There is an abundance of oxygen, but it is impure and unfit to breathe.

Every one should become intelligent in relation to the matter of ventilation, and should appreciate its importance. Vast and irreparable injury frequently results from the confinement of several scores or hundreds of people in a schoolroom, church, or lecture room without adequate means of removing the impurities thrown off from their lungs and bodies. The same air being breathed over and over becomes densely charged with poisons, which render the blood impure, lessen the bodily resistance, and induce susceptibility to taking cold and to infection with the germs of pneumonia, consumption, and other infectious diseases, which are always present in a very crowded audience room.

The Rate at Which Air Change Is Needed.

Suppose, for example, a thousand persons are seated in a room forty feet in width, sixty in length, and fifteen in height; how long a time would elapse before the air of such a room would become unfit for further respiration? Remembering that each person spoils one foot of air every second, it is clear that one thousand cubic feet of air will be contaminated for every second that the room is occupied. To ascertain the number of seconds which would elapse before the entire air contained in the room will be contaminated, so that it is unfit for further breathing, we have only

to divide the cubic contents of the room by one thousand. Multiplying, we have 60 x 40 x 15 equals 36,000, the number of cubic feet. This, divided by one thousand, gives thirty-six as the number of seconds. Thus it appears that with closed doors and windows breath poisoning of the audience would begin at the end of thirty-six seconds, or less than one minute. The condition of the air in such a room at the end of an hour cannot be adequately pictured in words, and yet hundreds of audiences are daily subjected to just such inhumane treatment through the ignorance or stupidity of architects, or the carelessness of janitors, or the criminal negligence of both. This is a question of so great importance that we will refer to it again a little later on, and will present a summary of the principles which govern scientific ventilation, by the application of which any building can be easily supplied with an adequate amount of fresh air, no matter whether it be a cottage, a college, a common schoolhouse, or a city church.

How Respiration Aids the Circulation.

The act of breathing is a blood-pumping process as well as the means by which air is removed in and out of the chest. Each time the chest wall is elevated after the lungs have been emptied and the succeeding inspiratory movement begins, a suction force is exerted upon the large veins which enter the chest, especially those which come in through the abdominal cavity. At the same moment, the downward pressure of the diaphragm by which the liver, stomach, and other abdominal organs are compressed against the muscular walls of the abdomen, serves to force the blood from below upward, emptying the venous blood of the abdominal cavity into the chest, thus helping it on toward the heart. The

more tense and well developed the muscles of the abdominal wall, and the stronger the muscles of respiration the stronger will be this upward movement of the blood. When the abdominal muscles are weakened by improper dress, tight lacing, or by the wearing of belts or bands, or by sedentary habits, especially sitting in a stooped position, the weakened muscles yield to the downward pressure of the diaphragm, thus neutralizing to a large degree the beneficial influence of this action. This condition is unquestionably a cause of chronic disease of the liver and stomach, inactive bowels, and possibly lays the foundation of cirrhosis of the liver, spleen, and other grave disorders of the abdominal viscera.

These facts call our attention to the wonderfully intimate relations which exist between the functions of different parts of the body. Vigorous breathing not only benefits the lungs and purifies the blood, but aids digestion, promotes the absorption of food, and assists the portal blood through the second set of capillaries in which it is spread out in the liver.

Breathing and Digestion.

The stomach lies just below the diaphragm, and a portion of the mechanical work of the stomach, the mingling of the food and the digestive fluids, is performed by the diaphragm, which, as it moves up and down, kneads the stomach and its contents, and so greatly aids digestion. In ordinary breathing in a quiet person the movements of the chest are so slight as to be scarcely noticeable, and the action of the diaphragm produces little effect; but by moderate exercise these movements are greatly increased, more than doubled, and the stomach is energetically kneaded. In this way, mod-

erate exercise after eating is beneficial. The practice of breathing movements such as those which are described elsewhere in this work is also very helpful for persons who have slow digestion.

Exercise out of doors is especially helpful. Fresh air, and especially cold air, sharpens the appetite, and creates a demand for food by burning up the waste matters with which the tissues are clogged, and preparing the way for new material, which digestion introduces into the blood.

Respiration During Sleep.

During sleeping hours the breathing movements are more superficial than when one is awake and active. They are also slower. The lungs and chest are a great central engine, which influences the activity of every organ, even every cell in the entire body. Lessened breathing during sleep slows down every function. It is necessary that activity should be lessened in order that sleep and rest may be secured, but the work of the liver, kidneys, and the repairing work of the living cells goes on during sleep, and this requires oxygen. Hence the body should be supplied with an abundance of fresh air during sleep by proper ventilation of the sleeping rooms. The lassitude experienced on rising in the morning after sleeping in a close, overheated room, is evidence of the injury resulting from such a practice. The temperature of the sleeping room should never be above 60° F., when a higher temperature can be avoided, and a lower temperature will be found beneficial. Sleeping in cool air, provided the body is kept warm, is far more refreshing, invigorating, and energizing than in a warm atmosphere. Cold air has a tonic effect upon the tissues which is highly beneficial.

The amount of air taken in during sleep may be increased by development of the vital capacity and the activity of the lungs through suitable exercise, and this to a very remarkable degree. An eminent French physiologist found that the amount of air taken into the lungs during sleep was doubled in students whose general breathing capacity had been increased by exercise. Exercise in a gymnasium, chopping and sawing wood, digging, laundry work, scrubbing, running of errands,— all sorts of active house work and farm work,— are excellent means of developing the chest. Any exercise which accelerates the breathing, compelling deep, full breathing, is valuable as a means for developing the lung capacity.

Languor, nervousness, and mental cloudiness are driven away by the increased ventilation of the body secured by deep breathing. The pure oxygen taken in burns up the rubbish which obstructs the brain and the tissues, while the deep breathing movements accelerate the circulation, drawing the impure blood toward the chest for purification, and so cleansing the tissues of the paralyzing poisons which are sure to accumulate in them unless constantly removed by vigorous movement of the blood and energetic breathing. The heightened color of cheeks, the increased luster of eye and general buoyancy of feeling which follow a brisk walk on a frosty morning, are evidences of the benefits to be derived from taking into the body an increased supply of oxygen through active breathing.

Vital Capacity.

The measure of the vital capacity is obtained by means of a simple instrument known as a spirometer, into which a person breathes after having previously inflated the lungs.

A person's effective vital capacity can be obtained, however, without the spirometer by testing his ability to endure exercise which taxes the breathing power, such as running up and down stairs, or in other running exercises. A person who gets quickly out of breath when undertaking an exercise of this sort needs to increase his breathing capacity. Breathing power depends as much on the strength of the muscles which control the chest walls as upon the size of the chest.

The proper time for the development of the chest is in childhood and in youth. The best of all means for increasing the chest capacity is running and active sports of all sorts. Mountain climbing, going up and down stairs, and all sorts of exercises which produce strong breathing movements, are effective means of chest development. Exercises of this sort are far superior to breathing exercises, so-called, of whatever sort. Breathing exercises in which the lungs are forcibly compelled to take in more than the ordinary amount of air, very soon become tiresome. The effort is wholly voluntary, and the muscles soon weary. When, however, a thirst for air is created by some active exercise which fills the blood with carbonic acid gas, so that deeper and more rapid breathing is necessary to rid the body of this poisonous gas and to take in a supply of oxygen in its place, the act of breathing is no longer difficult, embarrassing, or tiresome, but is, on the other hand, a pleasure and a gratification. The impulse which comes from within, from the so-called respiratory centers, so excites the respiratory muscles that they cause the chest to execute the strongest breathing movements with the greatest ease, ventilating every portion of the lungs, filling every air cell to its utmost capacity.

Cultivating Lung Capacity.

No physical endowment is of more importance for a long and a vigorous life than capacious lungs. The intensity and efficiency of an individual's life depends very largely upon the amount of air he habitually passes in and out of his lungs, just as the intensity of a fire, granting plenty of fuel, depends upon the rate at which the air is brought in contact with the fuel. It has been found that lung capacity depends very largely upon the height; thus, the taller a person, the greater his lung capacity, other things being equal. The following table shows the lung capacity, or rather the amount of air which can be forced out of the lungs, the so-called vital capacity, for men of different heights: —

Height. (*inches*)	*Weight.* (*pounds*)	*Vital Capacity.* (*cu. in.*)
64	115	205
65	126	228
66	126	230
67	133	244
68	134	248
69	140	254
70	141	256
71	150	272
72	151	287

Why We Breathe When Asleep.

While the lungs are to some extent subject to voluntary control, their action is, like that of the heart, automatic. During sleep as well as during the waking hours their movements are carried on with rhythmical regularity, except when necessarily interrupted by speech, and without any conscious or voluntary effort. Here again, as in the case of the heart, is an indubitable evidence of the presence within the body of an intelligent controlling power which presides over every function, each moment adapting every vital action to every other one, comprehending all, overlooking nothing, neglect-

ing not the slightest detail. "Behold he that keepeth Israel shall neither slumber nor sleep." Ps. 121:4.

Runners always have large and active chests, whereas sedentary persons have chests of limited capacity and rigid walls. When a chest is not stretched to its utmost capacity many times daily, it rapidly loses its flexibility. This is especially true after the age of thirty. In persons who have passed middle life, the rigidity of the chest is so great that there can be no very considerable increase in size. By development of the respiratory muscles the chest capacity may be to some degree increased, but the proper time for chest development is in childhood and youth. At this period, also, the integrity of the heart renders possible without injury those vigorous exercises which are essential to secure the highest degree of chest development.

Probably the best of all exercises for the development of the chest and breathing powers is swimming. The position of the body, the head held well back and the chest well forward, and the active movements of the arms and limbs, render swimming a most efficient breathing exercise. The contact of cold water with the skin also actively stimulates the movement of the chest, while at the same time it renders possible prolonged and vigorous muscular movements by increasing the energy and activity of the muscles.

Special breathing exercises, as well as those active muscular movements which induce a thirst for air, are beneficial to the lungs by maintaining the flexibility of the chest, strengthening the respiratory muscles, and ventilating the lungs. These movements also exercise a most extraordinary beneficial effect upon the stomach, liver, and other organs which lie below the diaphragm. Each time the diaphragm

contracts, it gives the liver, stomach, and adjacent organs a hearty squeeze, so to speak, emptying out the blood contained in these parts as one may by compression empty a moist sponge. All movements which increase the strength of the abdominal muscles are an important means of aiding and improving the breathing function. In a subsequent chapter, special directions will be given for such exercises as are well calculated to develop the muscles of the trunk, including those most concerned in breathing.

Dangers in the Air, and How to Avoid Them.

THE enemies of life which assail us through the medium of the air are chiefly associated with poisonous gases and dust. The gaseous poisons which are really injurious in character are easily discoverable, and are generally likely to be avoided because of their obnoxious odors. Smoke and odors arising from decomposition, chemical fumes, and sewer gas are readily recognized, though sometimes tolerated with an astonishing degree of equanimity, and by those whose intelligence should teach them the necessity of making an immediate change, either in their location or their surroundings.

Breath-Contaminated Air.

The most common of all sources of impure air is the human body, which is constantly throwing off poisons from the skin and the lungs. These poisons, while they seldom accumulate in the air to a deadly extent, never, in fact, except when a large number of persons are closely confined in a very small space, as has sometimes occurred in prisons and in storms at sea, are so closely associated with civilized modes of life it is probable that the majority of civilized people suffer more or less injury from the contamination of the air they breathe with these body poisons. There is thrown out upon the skin and evaporated from it a considerable quantity of poison-laden water, amounting to two and a half to three

pounds daily, and much more when the sweat glands are stimulated by exposure of the body to heat. A man working very hard on a hot day may evaporate from his skin as much as one fifth of his own weight of perspiration.

The lungs throw off every twenty-four hours nearly 3,000 gallons — one hundred barrels — of poison-laden air, every pint of which is capable of rendering unfit to breathe a whole barrel full of air. A little computation will show that the air breathed in a single day, to say nothing of the contamination resulting from emanations from the skin, amounts to more than seven hundred thousand barrels of air. Adding the effect of the skin emanations, we have nearly three fourths of a million barrels of air which are rendered unfit for breathing by each human body every twenty-four hours. To maintain air purity it is necessary that this impure air should be constantly replaced by pure air.

A savage living in a hut of boughs, or a soldier living in a tent, needs to give no attention to ventilation, for an abundant supply of fresh air will easily work its way into such a rude habitation. The same may be said of the log hut of the pioneer, heated with a capacious open fireplace. But those who live in modern air-tight houses of stone, brick, or wood must depend upon some systematic mechanical means by which the needed supply of air will be constantly and automatically furnished. When a house is heated by open grates, the problem is practically solved without further consideration, for the fireplace itself, and the wide chimney connected with it, acts as a most efficient ventilator as well as heater. The open grate is the most healthful of all means of heating. The radiant energy, falling upon the walls, warms them, and they in turn warm the room. The consumption of fuel is necessarily large, but the saving in

improved health and resistance to colds and disease of all sorts is very great.

The character of air contaminated by respiration may readily be shown by two simple experiments. The first experiment requires a bit of candle, a wire, a deep, narrow glass jar or a wide-mouth bottle, and a piece of tubing a foot or two in length. Either rubber or glass tubing may be used, or even a long dandelion stem, or a small cornstalk in lieu of anything better. The wire is attached to the candle so that after it is lighted it may be let down to the bottom of the jar. Putting one end of the tube in the mouth, place the other in the jar, taking care that the end of the tube reaches the bottom of the jar. Now cover the top of the jar as closely as possible, and breathe into it through the tube for half a minute, taking care to draw air into the lungs only through the nose, and breathing it out only through the tube. By this means the jar will be completely filled with air from the lungs. Keep the top of the jar covered, so that the impure air which it contains will not escape. A bit of candle which has previously been lighted so as to be ready for immediate use, is now let quickly down to the bottom of the jar. Watch the flame closely. It at once begins to diminish in size, becoming smaller and smaller, and finally goes out. It should be noted that if the mouth of the jar is left too widely open, drafts may be created which may change the air of the jar, and so permit the candle to burn. This may be obviated by partly closing the mouth of the jar, if necessary. This experiment shows that the expired air contains something which is capable of extinguishing a burning candle. The candle goes out because of the presence of carbonic acid gas in the out-going breath.

That the air which will extinguish a candle flame is also incapable of supporting respiration is shown by the following

experiment: After having filled a jar with air from the lungs, in the manner above directed, put into it a small mouse, taking care to cover the mouth of the jar immediately after the mouse is dropped in. Very quickly the animal will show signs of great uneasiness. Its breathing will become very rapid, and, if fresh air is not admitted, it will soon become stupid, then insensible, and unless removed, it will speedily die. Frogs, lizards, and insects will also die when deprived of air, but will live a much longer time than warm-blooded animals, as their life processes are so sluggish that they require much less oxygen.

Foul Air Outlets.

In the absence of a fireplace, a special arrangement for the removal of foul air must be provided. This should be constructed on the plan of the fireplace,— an opening near the floor connected with the chimney or an upright ventilating shaft. The size of the opening must depend upon the number of people for whom air is to be supplied. An opening of two by twelve inches should be provided for each individual. This would require a space ten by twelve inches for five persons. It should be remembered that this must be free space. If a grating is put over the opening, as is usually the case, the size of the opening must be at least one-half larger, or, for five persons, twelve by fifteen inches. This opening should communicate as directly as possible with an upright shaft of equal size, the top of which should extend above the roof like a chimney.

The Ventilating Shaft.

The ventilating shaft should always be located in an inside wall, and, if possible, it should be placed next to a

chimney which is always warm. The chimney heats the duct and increases the draught. The opening for the outlet of impure air should be at the bottom of the room when the house is heated by a furnace or by any other means which warms the fresh air before it is admitted to the rooms. If the fresh air is admitted cold, the foul air outlet should be at a higher level. The best point is perhaps at about four feet from the floor. This will secure a thorough admixture of the air. If the outlet is at the floor, the cold fresh air admitted to the room will pass out before it has been warmed and used, while the hot, foul air will accumulate in the upper part of the room, and thus the change of air will be imperfect.

Two openings must be provided to secure proper ventilation, one for the entrance of fresh air, the other for the exit of foul air. It is in every way better that the air should be heated, at least partially, before it enters the room, as this will to a large degree prevent the formation of a cold layer about the floor. In the author's opinion, the most perfect of all methods of heating, though somewhat expensive, is the combination of the furnace with open grates.

Coal Gas Poisoning.

All are familiar with the dangerous character of coal gas. A single gas jet left open in a room will in a short time render the air of the room irrespirable, and produce asphyxia. Many persons have lost their lives by blowing out the light as they would extinguish a candle, and going to bed, or as the result of a leak in a gas pipe. Suffocation has resulted more than once from the use of gas heaters and oil burners for heating purposes. As heaters of this sort are not connected with the chimney, the carbonic acid

gas produced by the burning is left in the air, and may accumulate in such quantities as to produce deadly effects. The heaters sometimes used for burning natural gas are open to the same objection. Such heaters are often used for a long time without ill effects, for the reason that there always happens to be left open a door or a window whereby sufficient air is admitted to prevent immediate ill consequences; but more or less injury is being continually produced, and sooner or later manifests itself. Coal stoves furnished with dampers are also a frequent source of air contamination.

The matter of ventilation should be carefully considered in the construction of a house. If the house is to be heated by a furnace, a duct should be brought from out of doors direct to the furnace to secure a supply of pure air. The furnace should never be allowed to take air from the basement nor from any part of the house itself. Those who put in furnaces sometimes insist on taking the air from the hall or some other part of the house as a matter of economy. This plan saves fuel, but at the expense of health, and hence is the worst sort of economy.

Ventilation of Sleeping Rooms.

The thorough ventilation of sleeping rooms is a matter of special importance. During the day the frequent opening of doors secures an occasional change of air at least. During sleep, which constitutes about one third of the total life of the average individual, the impurities which may accumulate in a closed apartment may contaminate the air to such an extent that a person coming in from out of doors will observe a distinct odor. Probably every reader has at some time had an opportunity to observe the peculiar

fusty odor of such a room. No person can stay any length of time in such a place without injury to health. The vitality of the body will be so weakened as to lessen its power to resist disease. The poisons of the breath seem especially to predispose to consumption or lung tuberculosis, a disease which is yearly becoming more frequent.

Post-mortem examinations show that nearly one half of those who live and die in cities have at some time suffered in some way from this dreadful disease. Many recover, but one fourth of all adults who die succumb to this malady. That the disease is largely due to the breathing of impure air, through living indoors, is shown by the fact that the best remedy yet discovered for consumption is an active out-of-door life. Many have recovered by exchanging the close house for a tent, and making a canvas hut their abode for a year or two, even during quite cold weather.

Draughts Not Necessarily Dangerous.

The popular notion that draughts are dangerous, certainly leading to the taking of cold, and that one should never sleep with a draught blowing upon his face, is responsible for much sickness and general vital weakness. Arctic travelers, soldiers who live out of doors, and consumptives who have been induced to adopt an out-of-door life, never take cold because of exposure to cold air during sleep. One takes cold, not by exposure to cold air, nor by sudden cooling of the body, but by the slow cooling which results from the evaporation of water from a moist skin. Many a person has taken a fatal cold as the result of the opening of a window in an overheated church, causing a draught of cold air to blow upon the overheated and perspiring bodies of the audience. Even impure air is less dangerous than a

draught of cold air when one is perspiring and not actively exercising. Exercise maintains the circulation, and so prevents the taking of a cold. Impure air does its work insiduously, slowly undermining the constitution.

Sleeping in Cold Air.

A person may take cold during the night, if while sleeping in an overheated room with a small opening for the admittance of air there may happen to be a change in the weather or the wind, so that a strong draught of cold air falls upon the overheated sleeper. To insure against cold while asleep, during the cold season of the year, it is only necessary to provide plenty of blankets,— woolen blankets are preferable to quilts, and are more easily aired and washed,— a warm woolen gown, a sleeping jacket or robe, and if necessary a flannel cap. The cap especially is necessary for persons whose hair is thin. A person so protected may sleep in a temperature below freezing without the slightest danger. A warm sleeping jacket or robe is especially necessary for children, who, in moving about, are likely to become uncovered during sleep, and thus take cold. It is dangerous to go to sleep in a warm sleeping room which is likely to become cold before morning, for the obvious reason that the body is likely to be overheated and insufficiently protected, and thus exposed to chill sufficient to induce a severe cold, even without awakening the sleeper. A cold is often contracted in this way in sleeping cars, which are often made veritable death-traps through the ignorance or carelessness of porters.

Dust Germs.

All dust is more or less dangerous. Examination of the lungs after death shows that while these organs are in infants

and young children of a pink color, nearly transparent, they are often found of a grayish and sometimes almost black color in adults, especially those who live in cities. The dark color is due to the accumulation of dust of various sorts in the lungs. A large part of the dust is filtered out by the nose, and the mucous membrane of the air passages captures a portion; but in spite of these provisions for the exclusion of dust, a considerable amount finds its way into the deeper portion of the lungs, and penetrates the tissues by means of the lymphatics.

The air of large cities is always filled with dust of a most dangerous character. Microscopic examinations of air dust shows it to be composed of minute particles of dirt, bits of cotton and wool fiber, particles of wood, and many other substances. The most important and dangerous element of dust, however, is minute living organisms known as germs or microbes. These are for the most part derived from the dry excreta of animals, particles of decomposing matter, and dry and pulverized matters expectorated by persons suffering from tuberculosis of the lungs and other lung diseases. There are also sometimes found in the air minute animal organisms which give rise to malaria and yellow fever, and sometimes other maladies.

Diseases Due to Germs.

A large share of the diseases to which human beings are subject may be directly attributed to the reception of germs into the body through the air. Smallpox, diphtheria, measles, scarlet fever, pulmonary consumption and pneumonia, and other so-called contagious, or catching diseases, are for the most part communicated in this way. Acute and chronic nasal catarrh, la grippe, or influenza, many diseases of the

ear, and most diseases of the skin, are also attributable to germs which are more or less constantly present in the air. Experiments seem to show that infection with these germs depends very largely upon the number with which one comes in contact. The healthy human body is perhaps able to defend itself against all forms of germs, but there are few people who are so healthy as to be able to resist an overwhelming number of these mischievous organisms. No one can afford unnecessarily to expose himself to infection.

How Germs Kill.

While the smallest of all living things, germs are the most deadly enemies of life to which human beings are exposed. Their power for mischief is chiefly due to two things: first, the great rapidity with which they grow under favorable circumstances; and second, their power to form deadly poisons, so-called toxins and ptomains. Some of these germ poisons are more deadly than any other poisons known to man, being capable of producing most powerful poisonous effects in doses so minute as to be almost imponderable.

Each germ produces its own particular sort of poison, which is capable of producing characteristic effects. Some germs, for example, produce narcotic poisons, other irritant poisons, still other poisons which paralyze, and which may cause almost instant death to every living cell with which they come in contact. The elevation of temperature which occurs in fevers of various sorts is due to the presence in the blood of fever-producing poisons formed by the particular germs which are active in the individual case. The processes of ulceration, inflammation, and suppuration are due to these germ-formed poisons.

The Marvelous Defenses of the Body.

It is important to understand, however, that the healthy body is able to defend itself against germs in a great variety of ways. For example, the skin is practically impervious to germs. The mucus of the nose, mouth, and intestines prevents the development of germs, and to some extent destroys them. The cells which cover the two thousand feet of lung surface are constantly engaged in capturing and destroying germs. As we have already learned, the white cells of the blood and the serum of the blood destroy germs when the blood is pure. The lymphatic glands are active germ destroyers. The germ-destroying process is also carried on in the millions of little lymph-filled pouches which dot the mucous membrane of the intestines. Ordinary germs cannot live for any length of time in contact with the living tissues, but when the body is deteriorated by wrong habits, such as improper eating, overeating, the use of tea, coffee, tobacco, and alcohol, the breathing of impure air, by sedentary habits, and whatever serves to lower vitality and tissue activity, the cells, being no longer able to defend themselves, permit the germs to enter and gain a foothold. Having once entered the body, they may extend their ravages from point to point until every organ is involved, and death occurs.

Germs Not a Direct Cause of Disease.

It thus appears that the cause of germ disease is not the germs themselves, but the weakening of the body by incorrect habits of life. A simple, natural life is the most effective means of defense against germs. Nevertheless, it is of the highest importance that we should avoid these agencies of death in every possible way. No person should through carelessness expose himself to contact with germs by the

inhalation of germ-laden dust or by contact with persons suffering from infectious diseases. Doctors and nurses, in pursuance of the duties of their professions, must often run great risks, which others are not justified in doing. No one can be certain at any time that the state of his resistance is such as to enable him to successfully endure contact with a large number of virulent germs. If one is necessarily exposed, the danger of contagion may be greatly lessened by cold bathing, pure food, out-of-door exercise, and other means which increase vital resistance.

How to Combat Germs.

First of all, dust should be carefully avoided. House dust is particularly dangerous, as it generally comprises a great variety of germs which have been brought in from the street on the feet, which have floated in with the air, and which have in other ways accumulated. Mere sweeping and dusting will not rid the house of dust. Sometimes these processes merely serve to keep germs floating, and to increase the danger of injury from them. The modern carpet sweeper shouid be substituted for the old-fashioned broom, so far as possible, at least, so as to avoid the stirring up of the dust. Dusters should be discarded; they only whisk the dust into the air, and it quickly settles back again on window sills, furniture, window curtains, and doors, ready to be dislodged again. The dust should be carefully wiped up with damp cloths, which should afterward be boiled or burned, so that the accumulated dust may be destroyed. Carpets should be discarded and rugs substituted. These should be taken out of the room, and beaten or shaken at least two or three times a week, more frequently in dusty or muddy weather. All sources of air contamination with germs should be re-

moved or destroyed. The pantry, the kitchen, and sinks, closets, and cellars must be so frequently cleansed that there will be no chance for the accumulation of fermenting or decaying materials, which are always the source of germs. Cesspools should be located far from the house, and should be water tight, so that the soil about the house cannot become saturated with germ-producing filth. Stables and animal pens should be located far from other buildings, and must be kept scrupulously clean. The custom of combining in one structure the home and the stable, which prevails in some European countries, is highly reprehensible.

Disinfectants.

Fire is the best of all disinfectants. Germ-producing matter should be burned wherever possible. The human excreta is so filled with dangerous germs that its use as a fertilizer should not be permitted. It should either be passed into large streams emptying into large bodies of water that are not used for drinking purposes, or thoroughly disinfected by the addition of suitable chemical agents, and then mingled with the soil.

Disinfection.

The disinfection of clothing is a matter which every one should understand. Ordinary boiling will destroy all sorts of dangerous germs. The boiling should be continued half an hour. Clothing which cannot be boiled should be burned or disinfected by sulphur or formalin.

Rooms must be disinfected by the last-named means and by thorough scrubbing with strong, hot soapsuds. We quote the following directions for disinfection[1] from the author's "Home Hand-Book of Domestic Hygiene," page 577:—

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1 Home Hand-Book of Domestic Hygiene and Rational Medicine, J. H. Kellogg, M. D. Published by Modern Medicine Company, Battle Creek, Michigan.

"1. Open doors and windows as widely as possible so as to allow the admission of the largest possible amount of light and the freest circulation of air.

"2. Remove the old paper from the walls, and burn it. Wash the bare walls with strong soapsuds, and then apply whitewash to the ceiling. Cleanse the woodwork with a solution of fresh chloride of lime, one pound to the gallon.

"3. Remove the carpet from the floor, the bedding from the bed, and every other fabric from the room, and thoroughly disinfect them before replacing.

"Ordinary scrubbing, whitewashing, and ventilation are useful and necessary, but are not sufficient. Disinfection is required. One of the most convenient and effective means of disinfection is fumigation by the burning of common sulphur. The following is the best method of doing this:—

"Into a tub or a large dishpan pour water to the depth of an inch. Place in the vessel two bricks laid flatwise and near together. Set upon the bricks an old iron kettle. Put into the kettle a proper quantity of flour of sulphur mixed with an equal quantity of pounded charcoal. The amount required is four pounds for each one thousand cubic feet of air. Mix with the sulphur and charcoal a few pieces of newspaper. Before the sulphur is lighted, all clothing and other articles in the room should be so disposed as to allow the fumes of the sulphur to come in contact with them to the fullest extent. The efficiency of the fumigation is also very greatly increased by saturating the walls, and everything the room contains, with steam. This may be very readily done by boiling water vigorously upon a stove in the room for an hour or two previous to lighting the sulphur. Dry sulphur fumes will destroy growing germs, but not the dried spores which may be collected upon walls and in cracks and corners. When

all is in readiness, light the sulphur, and leave the room as soon as it is evident that it is going to burn well. If the door of the room communicates with other rooms, the crack around the door must be tightly closed by pasting thick paper over it. The room must be kept closed for twenty-four hours, at the end of which time it should be opened, and left to air for another twenty-four hours, when it may be considered thoroughly disinfected."

Disinfection with Formalin.

The following is an efficient method of room disinfection with formalin, a new and very powerful disinfectant, which is somewhat more convenient in use than is sulphur, and is also more efficient: —

The disinfection of rooms with formaldehyde (the gas of the liquid formalin) is easy, inexpensive, thorough, and quite preferable to other methods in private homes, as it does not decolorize nor injure the most delicate fabric.

The windows, doors, and cracks should be sealed by strips of paper made to adhere with starch paste. Books should be suspended by their covers; clothing, etc., being hung loosely on a line in the room.

To insure more thorough disinfection, the room may be saturated with steam before the introduction of the gas, by vigorously boiling an open pan of water in the room, and sprinkling with water the articles most infected. All vessels containing water should be removed from the room, however, before beginning the disinfection.

Five ounces of commercial formalin are required for the disinfection of one thousand cubic feet of air space. The amount required for the room can be easily determined by calculating the cubic contents by multiplying together the

length, breadth, and height, and dividing by 1,000. Allow 5 ounces for each 1,000 cubic feet. Suppose, for example, the cubic contents of a room to be 2,500 cubic feet; 15 ounces of formalin would be required. The process is facilitated by adding one-fourth dram of borax to each ounce of formalin.

Formaldehyde may be produced by simply heating the formalin in the room, after having carefully pasted up the cracks around the windows and about the door, after closing it, so as to retain the disinfecting vapors as long as possible.

The liquid may be injected into the room by means of the ordinary Davidson's syringe. The liquid may be pumped directly from the bottle by passing into it the supply tube of the syringe. Care should be taken to avoid inhaling the fumes, as they are decidedly irritating, although not directly poisonous.

The best method of vaporizing formalin is the following: Place in the middle of the room a wide, thick board. Place on the board a half-inch layer of sand, and on this lay a couple of bricks which have been placed in the fire until quite hot. Pour the formalin quickly into a tin pan, set this upon the bricks, and quickly leave the room, or the pan containing the formalin may be placed upon a lighted kerosene stove. An old pan is better for the purpose, if it does not leak, as the vessels used for evaporating the formalin will certainly be spoiled, since the heat will continue long after the formalin has evaporated, it being unsafe to enter the room to turn down or remove the kerosene stove. Close the door tightly, and paste up the cracks at once.

Special apparatus which has been suggested by Dr. F. G. Novy affords the most reliable results. This consists of a tin can, in which the formalin is boiled by means of a gas jet, kerosene lamp, or kerosene stove beneath it. This lamp is

placed just outside the door of the room to be disinfected. A tube leading from the tin can is passed through the keyhole, so that as the formalin gas is generated, it is discharged into the room. A funnel tube placed at the side of the can passes into the can, and reaches within one sixteenth of an inch of the bottom. This serves as a means of introducing the formalin, which may be obtained at any drug store, and at the same time acts as an indicator.

When the liquid within the can is nearly all evaporated, the formalin vapor begins to escape through the tube, thus calling attention to the faet, so that the heating flame may be extinguished, thus preventing damage to the can.

The room should be left closed for ten hours, after which the doors and windows should be opened. After airing for a few hours, the walls, floor, and all furniture should be thoroughly scrubbed with strong, hot soapsuds. This is perhaps the best of all known methods of room disinfection.

Disinfection of Clothing.

Clothing which has been exposed to contamination by contagion, if of little value, should be destroyed. If more valuable, it may be disinfected in any one of several ways: —

"1. Heat in an oven as hot as possible without scorching, for an hour or two. A temperature of 250° will do no harm.

"2. If the clothing is uncolored, or colored with mineral dyes, soak a few minutes in a solution of fresh chloride of lime, of the strength of one pound of the chloride to a pailful of water. Afterward boil.

"3. Boil for one hour in a saturated solution of common salt. The addition of salt will raise the temperature a few degrees above the boiling point and insure the thorough destruction of germs and germ spores.

"4. Expose for several hours, in a closed box, to the fumes of burning sulphur. Air thoroughly afterward, and wash."

Disinfection of the Hands.

The disinfection of the hands is a matter which should receive daily attention. Fortunately, this is not a difficult matter. Recent experiments have shown that ordinary potash soap is one of the very best disinfectants. For disinfection of the hands it is only necessary to smear them by rubbing with a cake of yellow soap which has been dipped in warm water. The soap should be thoroughly rubbed in for ten or fifteen minutes, and should then be washed off with hot water, and the hands thoroughly rinsed with pure water and dried. Ordinarily, simply washing the hands with strong hot soapsuds prepared from laundry soap is sufficient, but when the hands have been exposed to some infectious material, such as the discharge from a suppurated wound, or by contact with other infectious matter, they should be disinfected in the special manner indicated.

Disinfection with soap is also important in the care of fever patients. The whole skin surface of patients suffering from typhoid fever in particular should be carefully cleansed with soap daily. The soap may be rubbed over the whole body in the manner directed, then after ten or fifteen minutes it should be washed off with a cloth dipped in warm water. Special attention should be given to those parts of the body likely to be contaminated with the bowel discharges. These parts should be thoroughly disinfected with soap after every movement of the bowels.

It should be remembered also that the air germs with which we come in contact accumulate in the clothing and upon the body. They also lodge in the mouth, under the

nails, and accumulate, sometimes even multiplying in the creases of the body, that is, beneath the arms, in the groins, etc., wherever the skin becomes moist; hence the importance of giving daily attention to the cleansing of these parts.

Soap as a Disinfectant.

As stated above, soap has been shown to be one of the best of disinfectants. The disinfecting power of soap is due to the alkali which it contains. Potash soaps are more effective than soda soaps. Green soap, which may be obtained at any drug store, is excellent for the purpose. There is nothing, however, superior to ordinary soft soap, such as is used for laundry purposes. Good, strong laundry soap of any sort may be relied upon. So-called antiseptic soaps, containing carbolic acid, tar, and other substances, have been shown by experiment to be no more effective as a disinfectant or cleansing agent than ordinary good soaps. Oily soaps are not efficient for disinfecting purposes. Care should be taken to thoroughly remove all traces of the soap by thoroughly rinsing the hands in soft water, or better still, washing in a running stream. The latter is the only really satisfactory method of cleansing the hands.

Sunlight and Diffused Daylight Destroy Germs.

Nature's great disinfectant is sunlight. It is a most interesting fact that this wonderful sunlight, which promotes the growth of useful plants and sustains animal life, at the same time destroys by its very brightness all sorts of germs which are brought in contact with it. It is this fact alone which renders the earth habitable. Germs develop with such marvelous rapidity that they would quickly overwhelm us by their very numbers if not constantly destroyed by the sun.

A little computation will readily show this. Some germs are capable of such rapid multiplication that they may double every fifteen minutes under favorable conditions of temperature and food supply. Estimate the number of germs which might be produced in a single day of twenty-four hours, or ninety-six doublings. The number would be more than thirty-two thousand billion billions, or sufficient to cover eighty thousand square miles a foot deep, or fill a space of more than fifteen cubic miles. The increase of a minute organism occupying a cubic space of not more than one twenty-thousandth of an inch to such prodigious magnitude is beyond comprehension, and practically cannot occur; for while the germ may grow at this immense rapidity for a short time, the poisons which it produces become destructive to itself. The material upon which it feeds is also exhausted, so that its growth ceases.

Doubtless all have noticed the fact that mold grows during the night and in dark, damp cellars. Bright sunlight quickly destroys germs, mold, and other parasitic organisms. Diffused daylight does not act nearly so rapidly, but accomplishes in the course of a few hours what bright sunlight is capable of doing in a few minutes. It is clearly evident, then, that in order that our houses should be kept free from germs, they, like our bodies, should be made full of light. The shutters should be opened, the curtains raised, and the light admitted to every room in the house, closets included, so that the disinfecting power of light may be exercised in every nook and corner of the dwelling.

Although these minute organisms are growing about us in great numbers they are for the most part so mingled with other grosser matters that they are hidden from sight. A powerful microscope is necessary to reveal the individual

germs, but we may easily produce growths or cultures of them in various suitable ways, one or two of which we will indicate.

How to Study Germs.

Select two or three very smooth, round potatoes of medium size. Scrub them with strong soapsuds made from soft soap or good laundry soap, without removing the skin. After they are thoroughly washed, steam them for half an hour in an ordinary steam cooker. At the end of half an hour remove the cooker from the stove, but do not open it. The purpose of the cooking is to destroy the germs on the outside of the potato. There are, of course, none on the inside. If the cover is opened, the potatoes are likely to become contaminated. While the cooker is cooling off, prepare a large, deep pie plate and an ordinary good-sized glass fruit dish that has a smooth edge. A large glass bowl would answer the same purpose. This should be thoroughly scrubbed with hot soapsuds so as to be as clean as possible, and finally should be immersed in boiling water for a few minutes. The glass bowl should be of such size that when it is inverted on the plate the edge will lie in contact with the bottom of the plate at its lowest part. When the dish is ready, put the plate on the table without touching the center of it with the fingers. Invert the glass bowl over it, taking care also not to touch it with the fingers. Add a tumblerful of water which has been boiled for ten or fifteen minutes; prepare also a sharp metal knife by first cleansing it thoroughly and then boiling it for ten minutes. The cleansing of the hands by thoroughly washing with strong soapsuds should not be omitted.

Take one of the potatoes from the cooker, and carefully cut it in halves, protecting it as much as possible from the air. Do not bring the potato in contact with the table or any other object. Avoid turning the cut surface upward. Raise the glass bowl, place the two halves upon the plate, with the cut surfaces upward, turn the glass bowl over them, and pour boiling water to the depth of a quarter of an inch on the plate. Cover all with a black cloth, and keep in a moderately warm place. After two or three days make a careful inspection. If the work has been carefully done, no change will be noticed in the potato. The cut surfaces will remain perfectly white and clear. If the cleansing has not been thoroughly done, or if sufficient pains has not been taken to avoid infection, a white, green, yellow, bluish, or reddish growth will be found spread over the cut surface of the potato. The color of the growth will depend upon the particular variety of mold or yeast which happens to have come in contact with the potato. If the surface of the potato remains white and clear, germs may be planted by collecting dust from a window sill, the pantry, and from various other places and transferring the dust by means of a knitting needle to the center of the potato. The knitting needle should be first boiled, then the end should be dipped in boiling water to moisten it. When this is brought in contact with the dust which it is desired to plant, a portion will adhere. The adhering particles may be rubbed upon the center of the potato. A mere touch is all that is required. Sometimes several different kinds of germs will be planted at once in this way, and the growth will be mixed; at other times a pure culture will be obtained.

The potato may be inoculated with saliva germs by first

touching the tip of the tongue with the end of the knitting needle after it has been dipped in boiling water or passed through a flame.

A very great variety of germ growths may be obtained in this way, some of which are very curious and interesting. A remarkable growth which sometimes appears is bright red in color, and it grows very rapidly. The same germ is sometimes found in milk which has been set overnight. There may be little red patches scattered here and there over the surface of the milk, or the whole may have acquired a red color. One variety of red germs grows upon bread, rice, and other farinaceous substances. In Germany there is a church where these germs abound. Bread exposed in the church is the next morning found to be colored red as though smeared with blood. This fact has been taken advantage of, and the appearance is claimed to be supernatural, and is called "the miracle of the bleeding bread." Thousands visit this musty old church annually to witness a miracle which can at any time be reproduced in the laboratory. Some years ago the author received from a gentleman residing in the West a specimen of rice which was covered with these germs, which appeared overnight, greatly to the astonishment of the household.

Another method of cultivating germs is the following: Take an ordinary wide-mouth bottle. Put into it a tablespoonful of white of egg. Put a cork in the mouth of the bottle. Put the whole in the oven, and bake for half an hour. The white of egg should be coagulated, but should not be browned or burned. To avoid overbaking, it is a good plan to bake the bottle for an hour before adding the white of egg, then return to the oven until the egg is coagulated. Material from different sources may now be

transferred to the surface of the egg in the bottle by means of the sterilized knitting needle, as before directed. In passing the needle into the bottle, the mouth of the bottle should be held down to prevent the entrance of germs. On withdrawing the needle, the cork should be introduced while the bottle is still held mouth downward, and the bottle should then be put in a warm place. Ointment bottles holding two or three ounces are convenient for this purpose. They can be easily carried in the pocket, thereby keeping them warm by means of the body heat. During the night warmth may be maintained by binding the bottles to some part of the body, or wrapping them up with a jug filled with water at about 100° F. It will be found very interesting to notice the different modes of growth of the different varieties of germs, and the differences in color and odor which characterize them. Care must be taken, however, not to become infected, as it is possible to come in contact in this way with some very active and virulent germs. Dangerous germs should not be handled in this way.

Are Germs Useful?

We hear so much about the deadly work of germs, we are quite likely to sometimes ask ourselves the question, "Why were these pernicious organisms created?" forgetting that while germs are constantly exercising their baneful activity in the destruction of human life, they are equally active in carrying forward many natural processes which are more or less essential to the maintenance of animal and vegetable life. It is through the action of germs, for example, that multitudes of animal and vegetable forms of life which are constantly dying are reduced to dust. By their work in the soil, material is prepared for the nourishment of plants. Many

germs also perform other useful offices. They are the great scavengers of nature, and we could not well dispense with them in our present state of existence. It is believed by many bacteriologists that all germs were originally useful, that the germs which produce disease have become virulent and dangerous to life through special conditions which have arisen in the natural world, whereby they have taken on new properties and powers, and by the development of susceptibility on the part of man through wrong habits of life.

The Skin and the Kidneys.

THESE two organs are so very much alike, though quite remote from each other, that they may properly be considered together, as their function and even their intimate structure are very similar. Both eliminate water in considerable quantities, and both remove from the blood acid and saline substances and various poisons. The hygienic rules which apply to one organ are also applicable to the other. One who will take care to maintain a thoroughly healthy skin will be likely to have healthy kidneys also.

The Structure of the Skin.

The outer covering of the body temple is remarkably adapted to its protection. When viewed with a microscope, its surface is found to be made up of several layers of horny scales, which form a protective layer that is a poor conductor of heat and electricity, but affords a considerable degree of resistance to the entrance of foreign bodies, the bites of insects, and the introduction of poisons. It also protects against the entrance of germs. Beneath this layer are found the active portions of the skin, glands, nerves, and blood vessels, by which are performed the various functions that are carried on by this remarkable organ. Of the glands, there are two kinds, we may perhaps say three. They are the perspiratory, or sweat, glands, consisting of a long tube leading from the surface to the deeper layers of the skin, ending in a little coil. The walls of these tubes are filled with blood vessels, and, spread out, would cover

a surface of ten or eleven thousand square feet. These glands secrete water containing salt and various waste substances. Under certain conditions, the sweat may also contain a slight amount of acid. Under ordinary conditions these glands pour out perspiration upon the skin at the rate of about one and a half ounces per hour. Heat and exercise may increase their activity to more than forty times the ordinary rate.

There are also found in the skin small glands which secrete fat. This is poured out upon the skin as a protective. The fat glands also probably to some extent act as purifiers of the blood by removing wastes.

Here and there are found little pockets in the skin from which grow the hairs, which, like the nails, are hardened growths from the skin.

The skin is very rich in blood vessels, the capillaries of which, by a peculiar arrangement of the skin structures, are made to lie between bands of muscular tissue. These, under some circumstances, are able to contract and compress the vessels in such a way as to almost completely empty them.

The Temperature Nerves.

The skin is a most remarkable structure in the large number and variety of the nerves which it contains. It receives special nerves for its glands, others for its blood vessels, nerves which appreciate pain, pressure nerves, the tactile nerves, which enable us to recognize the location of any part which is touched, and the temperature nerves of two kinds — the so-called hot and cold nerves. There are at least seven or eight different kinds of nerves in the skin. As several

of these will be considered elsewhere, we will here consider only the temperature nerves.

By the aid of the temperature nerves, the skin becomes like the eye, an organ by which it is possible to recognize light. The skin may in a certain sense be considered an extended eye. Some lower animals possess no other eyes than their skins, which are, however, extremely sensitive to light. This function of the skin is quite generally overlooked. Its importance can scarcely be appreciated until we have learned something more of the nature of light, one of the most wonderful of all the forces with which we are daily in contact. A word further, however, in reference to the thermic nerves.

There are two kinds of temperature nerves, as can be easily demonstrated by touching the skin with hot and cold points. It will be found that the hot points are felt at certain places and the cold points at certain other places. Those parts of the skin which are sensitive to cold are not sensitive to heat, and vice versa. These hot and cold areas are, of course, very small, and can only be detected by very careful observation. The information communicated by the thermic nerves is relative rather than positive. An object is felt as cold when it has a lower temperature than the skin or some other object which has just before been in contact with the skin. In this way one hand may be made to report an object as warm, while the other hand reports it as cool or cold. Very hot and very cold objects are not felt as such, but give rise to impressions of pain. Temperatures near that of the body are said to be neutral, because they do not stimulate either the hot or the cold nerves. The skin is more sensitive to cold than to heat, and cold is more quickly

felt than heat. Objects that are good conductors, and so transmit heat to the skin or withdraw heat from it rapidly, feel warmer or colder than other objects whose temperature is the same, but which are not good conductors of heat. The temperature sense becomes quickly fatigued. It is for this reason that water which is so cold or so hot as to be at first painful, after a few seconds can be readily tolerated.

The Wonderful Properties of Light, and its Effects upon the Skin.

Modern researches have shown that a sunbeam contains at least three different kinds of light rays; namely, heat rays, luminous rays, and chemical rays. When the ray of light is decomposed by a prism, as seen in the rainbow, the heat rays are found chiefly in the red portion, the luminous rays in the yellow portion, while the chemical rays have a violet color. There are also invisible heat rays and invisible chemical rays. All these different rays act upon the body through the skin, but in different ways. The thermic nerves are especially stimulated by the luminous and heat rays. The chemical rays without doubt act upon other nerves. So-called "sunburn" is produced by excessive action of the chemical rays, and is an inflammation rather than a burn. The browning of the skin produced by exposure to the sun is due to the action of the chemical rays. These are also the rays that are useful to the photographer. The existence of invisible chemical rays is shown by the fact that a distinct photograph may be obtained of invisible writing made with a solution of quinine, which acts upon the chemical rays, though not acting upon the luminous rays. Though invisible to the human eye, these rays are recognized by the eye of the camera.

All these visible and invisible rays are associated with the sunbeam, and exert a powerful influence upon human beings, as well as upon animals and plants. The powerful stimulating effect of light is shown by its influence upon vegetation in the spring.

Unquestionably, the civilized portion of the human race suffer greatly because of their exclusion from the influence of the sun's rays by thick and dark-colored clothing, and by dwelling so much indoors. This evil should be remedied, so far as possible, by out-of-door life and frequent exposure of as large a portion of the body as possible to the active influence of the sun's rays, by swimming in the open air, by means of the sun bath, the air bath, and the sand bath. Every school, and when possible, every home, should have connected with it a large out-of-doors gymnasium, in which the benefits of the sun's rays may be enjoyed in the summer time. Sun rooms should also be connected with every home, where the beneficial effects of light may be enjoyed to the fullest extent possible, as one means of counteracting the deteriorating influence of civilized modes of life.

Skin Training.

An enormous amount of time is devoted to the training of the hand, the eye, and the brain, but the training of the skin is seldom thought of. Nevertheless, a well-trained skin is more essential to health than almost any other kind of bodily culture. The neglect of the skin must be regarded as the foundation cause of a large number of chronic maladies. It may almost be asserted that a man who will keep his skin in a thoroughly healthy condition may defy almost any known disease. The experienced horseman knows very

well the importance of attending to the skin of the animal under his care. A horse which has a hidebound skin, with the hair dry and rough, is by this fact alone known to be in a state of disease. A man whose skin is hidebound, with the hair dry and dingy, dull and lifeless, in appearance, shows by this fact that his whole body is in a state of disease.

A healthy skin is warm, slightly moist, smooth, reddens quickly when rubbed or exposed to the action of hot or cold water, is supple and elastic, perspires readily under exercise or the application of heat, and is free from pimples, eruptions, and discolorations.

To maintain this condition, the skin must be subjected to daily bathing and grooming. Horsemen rub and groom their charges daily. Wild and domestic animals left free in the field habitually groom themselves by vigorous rubbing against trees or other objects. Hunters are familiar with this fact, and often secrete themselves near a "rubbing tree," as a means of getting an easy shot at their game. Man, of all animals, neglects to groom himself, and this is especially true of civilized man, for, as is well known, the savage and half-civilized nations from time immemorial have practiced rubbing of the body as a means of maintaining health.

The Morning Bath.

A daily bath should be taken regularly on rising. The temperature of the water should be cold, or at least cool, so that a strong reaction may be produced. The application should be brief, not more than half a minute to one or two minutes at the longest, and should be followed by quick drying and vigorous rubbing with the towel. The lower the temperature of the water, the shorter should be the duration of the bath. The purpose of the morning bath is not clean-

liness, although it aids in keeping the skin clean, but is skin gymnastics or training. When very cold water is applied to the skin, there is a sudden contraction of the blood vessels. This is quickly followed, after the application, especially when the skin is thoroughly rubbed, by a dilatation of the vessels of the skin, which causes reddening of the surface and a feeling of warmth, though the skin may still be cool, and a general sensation of buoyance, exhilaration, and vigor.

This sort of bath is a real exercise or vasomotor gymnastics for the skin: When taken daily, the nerves and vessels of the skin are maintained in so healthy and vigorous a state that they are able quickly to react when exposed to the cold, thus avoiding the injurious effects which follow slight exposure, and in most persons give rise to what is commonly known as "a cold," a condition which not infrequently serves as an introduction to pneumonia, consumption, chronic catarrh of the nose, throat, or chest, rheumatism, and various other maladies. Persons who practice daily cold bathing are little subject to colds.

The idea that the daily bath is debilitating and injurious, and especially that cold baths are weakening and dangerous and lead to consumption, etc., is entirely an error. It is only the abuse of the bath that is to be condemned. A short cold bath taken in a warm room, followed by vigorous rubbing and exercise until a good circulation is established, has never been known to injure any person; but care must be taken to secure prompt and thorough reaction. If the hands and feet continue cold for some time, or the head aches, the bath should be shorter, the rubbing more vigorous, or perhaps the exercise should be continued for a longer time. By degrees the ability to react improves, so

that colder water and longer applications may be advantageously employed.

The benefits of the cold bath are not experienced in the skin alone; the whole body partakes in the reaction. The contact of the cold water with the skin arouses the brain and the spinal cord, the heart, lungs, liver, and every internal organ to renewed activity. The heart pumps with renewed vigor, blood is forced in to every nook and corner of the system, the sluggish brain is aroused, the slow stomach is awakened to action, its glands are stimulated to produce gastric juice, a craving for food follows, and with the improved appetite comes improved digestion. The whole body is excited to increased activity. With the dilatation of the surface vessels and the filling of the skin with blood, the congested brain and other organs which have been overfilled with blood are relieved; their burdens are lightened, and the wheels of life run more swiftly and with lessened friction. The cold morning bath is the most powerful of all tonics known, and its daily employment is a duty which every civilized being owes to himself. It is not simply cleansing or polishing of the outside of the temple, but through the association of the inside with the outside its effect is a brightening and polishing of all the temple furniture and of every inner apartment.

The Cleansing Bath.

That God requires the duty of cleanliness is indicated clearly, not only by the instinctive abhorrence of dirt which every unperverted human being possesses, but by numerous Biblical precepts and suggestions. The duty of cleanliness was impressed as one of the most important features of

the regulations imposed upon the children of Israel by Jehovah through Moses. In the performance of their daily service in the temple, the priests were required to maintain the most scrupulous cleanliness by frequent baths and by cleansings of various sorts. The Egyptian priests bathed in cold water four times daily. The prophet Ezekiel says, "Then will I sprinkle clean water upon you, and you shall be clean from all your filthiness." Said Job, "If I wash me with snow water, and make my hands never so clean," recognizing the fact that soft water is the best of cleansing agents. The apostle Paul exhorts the Corinthians, "Let us cleanse ourselves from all filthiness of the flesh and spirit, perfecting holiness in the fear of God." 2 Cor. 7:1. It is as much one's duty to maintain a clear skin as a clean conscience. There is unquestionably an intimate relation between the two, and we are assured that "cleanliness is next to godliness." A famous divine, on being asked on which side of godliness cleanliness should be placed, wisely replied, "On both sides."

The cleansing bath is preferably taken at night, just before retiring. This lessens the danger of taking cold, for the cleansing bath, in order to be thoroughgoing, must be taken at such a temperature as will induce perspiration. A person whose occupation is not sufficiently active to produce vigorous perspiration daily should secure a good sweat at least twice a week, and, better, three times. Sweating need not be prolonged more than ten or fifteen minutes, and even a lesser time will be found beneficial. Sweating is necessary to relax the skin, to fill the blood vessels, to excite the respiratory glands to activity, and thus prevent their becoming permanently inactive by disease, and softens and loosens from the

skin the accumulated waste and poisonous substances which have been separated from the blood by the sweat glands and deposited upon the skin.

The cleansing bath may consist of either a full bath, a vapor bath, a wet-sheet pack, or any convenient form of sweating bath, the methods of taking which will be found described in the chapter devoted especially to baths.

How the Temple is Warmed.

AS we have already learned, there is a slow combustion taking place in the body all the time by the burning of the food. The several food elements — starch, sugar, fats, albumins, and even vegetable acids — furnish fuel for the maintenance of the bodily heat. Of the several different kinds of fuel-food, fats furnish the largest amount of heat. The body requires, per diem, about ten thousand heat units; that is, about as much heat as would be required to raise the temperature of ten thousand pounds, or five tons, of water one degree in temperature. Each ounce of fat produces about one thousand heat units, or heat enough to raise a thousand pounds of water one degree in temperature; hence, the total amount of heat required for the body would be produced by ten ounces of fat. An ounce of starch, sugar, or albumin produces about half as much heat as an ounce of fat, or five hundred heat units. Hence twice the amount of these substances would be needed, or twenty ounces.

The Amount of Body Heat Produced.

The amount of heat required depends upon the amount of clothing worn, upon the temperature of the surrounding air, and to some extent upon the amount of moisture contained in the air; hence, there must be a constant regulation of the heat functions of the body so that the temperature of the body may be maintained at the right point, which is at about one hundred degrees, neither falling much below nor rising much above the normal temperature. The ordi-

nary variations in health are very slight, amounting to less than a single degree. If the temperature is taken by placing the thermometer in the mouth or under the arm, it is found to be slightly above 98° F. But this is the temperature of the muscles, which is slightly lower than that of the deeper parts. The regulation of the temperature of the body requires constant adjustment; first, of the heat production, and second, of the heat loss or elimination. The heat is produced chiefly in the muscles. The heat loss takes place at the surface of the body. Of the different substances previously mentioned, the best heat-forming food is starch, for the reason that it is very quickly and easily digested when properly prepared, and is a bland, unirritating substance which does not irritate the mucous membrane by contact. Starch has the still further advantage that after digestion it is very quickly and easily absorbed, for the sugar formed of starch is one of the most readily soluble and diffusible of all known substances. Fat, on the other hand, is digested very slowly, and is taken into the blood very slowly indeed, the little particles of fat having to be taken in bodily through the mucous membrane instead of being dissolved and absorbed in solution, as is the starch.

Starch has another advantage over fat as a fuel-food in the fact that after being digested and absorbed, it is easily and quickly converted into animal starch, a substance to which it is very closely allied, and which is the most natural and easily combustible body fuel. Before fats can be burned, they must be converted into glycogen, which is effected slowly and with difficulty by the liver, thus imposing an extra task upon this overworked organ. It must

be remarked, however, that the sugar which is found in the juice of fruits and other natural sugars, is, when taken in its natural state, not only a complete and perfect substitute for starch, but has an advantage in that it is already completely digested, and ready for immediate absorption. This remark does not apply to the cane sugar of commerce, for reasons given below.

Albumin is not a good fuel-food, for the reason that it cannot be readily stored in the body, as can starch and fat. These latter elements, when taken in greater quantities than needed for immediate use, are stored in the liver and the muscles in the form of glycogen or animal starch; but if taken in still greater excess, are stored as fat beneath the skin and in other convenient places. Albumin, if taken in greater quantity than is needed for the repair of muscles, nerves, and other living parts, is by partial burning converted into uric acid and other very poisonous substances,— tissue cinders, which cause rheumatism, nervousness, neuralgia, Bright's disease, and a great variety of maladies.

This error is almost unavoidable when meat is freely used as a food. Meat eaters nearly always consume much too large a quantity of albumin or proteid, and hence are subject to rheumatism, gout, and other diseases which arise from uric acid poisoning. Dr. Haig, an eminent English authority, has by a long series of experiments, extending through many years, clearly demonstrated the correctness of this view.

Cane sugar is not a good fuel-food, for the reason that when taken in even moderate quantities it irritates the mucous membrane of the stomach, and gives rise to catarrh and chronic inflammation of the stomach, which may extend to the small intestine, the liver, and other parts. Its large use

gives rise to diabetes, rheumatism in elderly persons, to rickets in children, and indigestion in all classes. Cane sugar is found chiefly in grasses and vegetables. It is excellent food for cows, but not well adapted to human use.

Regulation of the Body Heat.

We have already learned that the liver stores up in itself a large part of the starch that is taken at each meal, doling it out in small doses as the body requires it for use as fuel and in work. In this function we have a wonderful illustration of the divine intelligence displayed in the body in the continual and momentary provision for its needs. In addition to this method of heat regulation, a wonderfully interesting arrangement is provided, whereby the process of heat-making which is carried forward in the muscles, the chief source of heat, is regulated by certain nerve centers in the brain and spinal cord. Special nerves connect these centers with the muscles, so that the process of heat production is under constant and absolute control. When the body is exposed to the influence of cold air or cold water, or is in any way cooled so that the temperature of the blood is lowered, even in the slightest degree, nerve centers in the brain recognize the lowered temperature, and immediately excite increased activity in the heat-making organs.

An ordinary thermometer is so sensitive to heat that the tip of the finger placed upon the bulb will cause the mercury to begin ascending at once. A body thermometer of the kind which is used by physicians in taking the temperature of patients is still more sensitive. But the heat centers in the brain are far more sensitive than any thermometer, detecting the slightest changes in the tempera-

ture of the blood, and adjusting the heat-making process thereto.

These heat centers are also influenced by impressions of heat or cold made upon the surface of the body through the action of the temperature nerves which are connected with them. A sharp, cold impression, for example, causes the nerve centers to immediately start the heat-making processes in anticipation of the cooling of the blood before the cooling has taken place. Similarly, a very hot application to the skin causes a lessening of the heat production, and before the application has been continued long enough to raise the body temperature. This fact is exceedingly interesting, and is constantly made of practical use by lumbermen, who, when working in the woods in the winter season, finding their feet in danger of freezing from the intense cold, often remove their boots and stockings, and quickly rub their feet with snow, with the result that the feet are quickly warmed by the reaction and the local increase of heat which is thereby produced.

Short, very hot applications are sometimes made to the skin in case of fever, as a means of lessening the heat production, when for any reason cold applications cannot be used.

The Cause of Chill.

When the cooling of the body is continued to such a point as to produce a considerable fall in the temperature of the blood, a chill is usually produced. Shivering consists in a rapid contraction of the muscles, in which nearly all the muscles of the body participate. As muscular action is always accompanied by heat production, this is an automatic

method of warming the body. In shivering, a person may contract his muscles more rapidly and for a longer time than he could possibly do by any effort of the will. The warming effect of exercise is familiar to all. So a chill is simply a natural method by which the body is exercised in order to increase the amount of heat production. Here is another illustration of the wonderful intelligence displayed in the body in all its muscular work.

The Regulation of Heat Loss.

The heat loss must also be regulated. While heat production chiefly takes place in the muscles, heat regulation occurs at the surface, through changes which take place in the blood circulation of the skin under the influence of special nerves and nerve centers. The blood is heated in the interior of the body. At the surface, the temperature of the blood is lowered by contact with the air and by evaporation of moisture from the skin. Thus the blood is continually carrying the heat from the interior to the surface to be absorbed by the air, thrown off by radiation, or utilized in the evaporation of the sweat. Under the influence of the nerves and the nerve centers, these heat-eliminating processes are perfectly regulated. It is evident that the more widely the arteries of the skin are dilated, the larger the amount of blood which will pass through, and consequently the greater will be the amount of heat given off. On the contrary, when the vessels are contracted the amount of heat loss at the surface will be diminished, as less blood will be brought to the skin to be cooled by exposure to the air. It is easy to see that the heat loss may be easily regulated by the contraction and dilatation of the surface vessels. This process may be easily observed. The application of cold

to the skin causes it to become pale at once by contraction of the vessels, whereas a hot application causes reddening of the skin by dilatation. The face and even the whole surface will be flushed and red when the body is exposed to a warm atmosphere, because of the general dilatation of the surface vessels. By these changes in the circulation of the skin, the heat loss may be increased to three or four times the normal amount, or diminished in like proportion.

Cooling of the Body by Perspiration.

Another very interesting method by means of which the heat loss is modified is the regulation of the action of the sweat glands. By the evaporation of the sweat a large amount of heat is carried off. In the evaporation of one pound of water as much as one thousand heat units are absorbed; that is, as much heat is consumed in the evaporation of a pound of water as would be required to raise half a ton of water one degree in temperature. About two and a half pounds of water are evaporated from the skin daily, representing a heat loss of about two thousand five hundred heat units, or one fourth of the entire amount of heat generated in the body. The amount of water thrown off by the sweat glands may be increased by exercise and exposure of the body to heat, and hence by this means the heat loss through evaporation may be greatly increased.

The remarkable arrangements for the regulation of heat production and loss are among the most interesting and necessary phenomena of life, and demonstrate in a most striking manner the presence of an intelligent control of every bodily function in the interests of the general welfare of the body. Similar provision is made for the lower animals which belong to the warm-blooded class, though not altogether in the

same way. In flesh-eating animals the skin does not sweat, but the blood is cooled by the evaporation of moisture from other surfaces. In the dog, for example, this evaporation takes place from the surface of the lungs. This is why a dog pants when overheated either by exercise or by hot air. By the act of panting, the air is rapidly passed out and in the lungs, and so by the evaporation of moisture cools the blood. The common house cat has large and active sweat glands on the soles of its feet.

So-called cold-blooded animals, such as fishes or frogs, have but little power to regulate their temperature, and consequently assume a temperature near that of the water or air with which they are surrounded. Children and aged persons have less power to regulate their temperature than have healthy adults. In other words, they are more nearly like cold-blooded animals, and hence require special care to prevent injury from extreme cooling or overheating of the body.

Fever.

In fever, the heat centers are disturbed by the poisons which are circulating in the blood, and in such a way that heat production and loss are not so perfectly controlled as in health. In some fevers, as, for example, in typhoid fever, the body seems to establish a new standard of temperature at about 101° to 102° F., or 2° to 3.5° F. above the normal. Let us see the reason for this.

Within a few years a remarkable fact has been discovered that affords still another illustration of a divine intelligence in the body, and the constant exercise of a beneficent will in defending the body against the enemies of life, as well as in the carrying forward of the ordinary functions. It

has been ascertained by experiment upon animals and observation on human beings that elevation of the temperature of the blood is one of the most effective means of destroying the disease germs which are present in the body in fever.

In the exact adaptation of the processes of heat production and perspiration to the changing temperature of the surrounding atmosphere and the varying conditions of the body, we have a most marvelous evidence of an intelligent presence, a most beneficent care. These processes are absolutely beyond the control of the human will. It is quite impossible for one to raise the temperature of his body one half a degree by an effort of the will. One cannot by mere thinking cause a perspiration to appear upon his brow, nor can he arrest perspiration by commanding the skin to cease its activity. One can control his muscles, at least a part of them, by an effort of the will, but the sweat glands and heat-producing organs are as much beyond the control of the will as are the heart, the stomach, the liver, and most of the other vital activities; yet these heat-regulating functions are all controlled with a nicety which is altogether beyond our comprehension. A change of temperature of one degree, or even less, necessitates a readjustment of the process of heat-making and the throwing off of heat. The opening of a door or a window, the opening or closing of a register, necessitates a change in the finely balanced adjustments whereby the body temperature is maintained at the normal standard.

In the presence of such evidence of divine care and protection, who can doubt that the Creator of all things is intimately, constantly, and personally interested in each one of the creatures he has made. We are thus continually reminded that the God revealed to us in nature, as well as in the inspired Word, although but dimly recognized by the Athenians of old,

and hence worshiped as the "UNKNOWN GOD," and to-day acknowledged by scientists as the "Unknowable," is, as the apostle declared, "not far from every one of us," and is really an actual personal presence which enters into all our experiences, knows all about our difficulties, recognizes our real purposes, gives us reason and life, and offers us an infinite supply of grace and strength,—"a present help in every time of need."

What a splendid foundation for religious faith, for belief and trust and confidence in an unseen but ever present and infinitely great and gracious Father of all flesh and Creator of all things is to be found in these evidences of personal care and interest in individual human welfare! The scientist may regard this great being as "unknowable," but not so the Christian man who finds in his daily experience the unmistakable tokens of a guiding hand, the hand of a friend, a brother, a father, a helpful, sympathizing, uplifting guarding hand.

The Clothing of the Body.

THE natural clothing of the body is the skin and the hair. This is true of man as well as of other animals. Savage tribes who live in the mild climate to which man is naturally adapted, find little or no clothing necessary for either health or comfort.

Civilized man requires clothing both for protection and to satisfy the demands of modesty. Custom goes farther, and finds in clothing a means of body decoration or ornamentation, even going so far as to change the form of various portions of the body, producing the most cruel and hideous deformities, and often with the most disastrous results.

Protection of the body by clothing is required, first to prevent too rapid a loss of the body heat, and second, to shield the body from the chemical rays during exposure to intense sunlight. Experiments have shown that it is not possible for the body to maintain its temperature if exposed without clothing to air in a temperature of less than about 86° F. The temperature in which an individual actually lives is that of the air next to the body inside of the clothing, and sufficient clothing must be worn to maintain this temperature, which, ordinarily, is about 77° to 86° F. In temperate climates, considerable clothing must be worn in summer as well as in winter to accomplish this. The ordinary man requires from six to eight pounds of clothing in summer, and about twice as much in the winter season. This refers, of course, to those who are exposed to the out-of-

door temperature. Those who live altogether indoors, require very little more clothing in winter than in the summer season.

Animals regulate their skin clothing to suit the season, shedding their thick hair in the spring, and growing a dense, thick covering for protection in the winter season.

The Properties of Different Clothing Materials.

Different substances behave very differently in relation to the transmission of heat, absorption of moisture, and permeability to air; and consequently the material with which clothing is made has a very important relation to health. The color is also important, as we shall see. Linen absorbs moisture much more rapidly than does wool, and dries more than twice as quickly. This is also true of cotton to a less degree, and to a still lesser degree of silk. Quick moistening of a fabric is a test which is constantly employed to distinguish linen from cotton.

The Best Material for Underclothing.

As the skin is constantly throwing off moisture, it is very important that the clothing shall be able to take it up and transmit it to the air. Woolen goods hold the moisture for a long time, and accumulate it, and with it of course are retained the various excretory substances which escape from the body in the sweat. It is on this account not well adapted for garments to be worn next to the skin. Linen is superior to all other fabrics for this purpose. Cotton stands next in value. The fact that the quick drying of linen exposes the skin to rapid cooling by evaporation, necessitates the wearing of outer garments of wool to prevent the too rapid loss

of heat during those seasons of the year when extra precaution is required, which means practically every day in the year in nearly all parts of the world. The only exceptions are those extremely hot localities in the tropics in which the temperature ranges high both day and night.

Loosely woven garments are decidedly preferable to close fabrics, for the reason that they are more permeable to air, and hence allow a frequent change of the air in contact with the body. Warmth may be obtained by increased thickness. The air inclosed in the meshes of a fabric constitutes an excellent nonconductor. Several thin garments are on this account much warmer than one thick one, the interposed layers of air having a high protective value.

It is interesting in this connection to note the fact that in the ancient Jewish service the priests were required to be clothed with linen (Exodus 28). "They shall be clothed with linen garments; no wool shall come upon them, whiles they minister in the gates of the inner court . . . they shall not gird themselves with anything which causeth sweat." Eze. 44:17, 18.

The false shepherds of Israel were reproved because they ate fat and clothed themselves with wool. Eze. 34:3. The progress of science, especially in modern times, has brought out more and more clearly from year to year the fact that in all the sanitary regulations of the Mosaic code there was a sound scientific basis, and a physical as well as a spiritual significance.

The wearing of linen next to the body is certainly conducive to cleanliness. Linen undergarments prevent undue heating of the skin and accumulation of moisture, which has the effect to relax the skin and maintain constantly in a moist and decomposing state the excretory substances thrown

off. Linen undergarments are also less irritating than those made of wool. This fact is recognized by many persons whose skins are especially sensitive. Linen may be worn at all seasons of the year. It is only necessary to provide sufficient outer clothing to secure the necessary warmth. An additional pair of thick undergarments affords better protection than extra outer wraps, and are less expensive.

White Garments Preferable to Colored.

The color of the clothing is of importance, because of its transmission and absorption of the sun's rays. Dark-colored fabrics, especially that of rough texture, absorb the heat rays, and this leads to an accumulation of heat. At the same time, however, they protect the body from the chemical rays of the sun. In Egypt and other hot countries, it is very common to see persons who are not provided with parasols or sun shades going about carrying upon and about their heads an enormous bundle, consisting of a blanket or shawl wrapped about it, as a protection against the intensely active rays of the sun. The dark hair and skin of the natives of Africa and other hot countries is provided them as a protection against the chemical rays. White cloth reflects all the rays of light, and may thus afford protection, provided the fabric is thick enough so that the light rays do not penetrate. The most complete protection from the sun's rays is afforded by a white garment lined with a dark fabric of some sort. Such protection is only required, however, under very exceptional circumstances, and when one is exposed to the direct rays of the sun. The head is, in fact, ordinarily the only part of the body which requires protection, and for this, ample protection is afforded by hats of various sorts,

with the addition of a moist cloth laid inside upon the head, if necessary. The heads of work horses may with advantage be protected in like manner by means of a straw hat and a wet sponge.

On the whole, white garments offer advantages over those of any other color, for the reason that they transmit a considerable amount of light. Contact of light with the skin is necessary for its health. Exposure of the skin to the direct rays of the sun is also advantageous and promotive of skin cleanliness, as by this means many disease-producing germs which accumulate upon the skin may be destroyed, even though they may have escaped removal by the bath.

The exhortation of the prophet, "Come ye, and let us walk in the light of the Lord" (Isa. 2:5), has a physical as well as a spiritual application. Light is energizing and vitalizing to a marvelous degree. The body of one who clothes himself in white garments is continually bathed in light during the hours of daylight. It is the universal custom of the peasantry in Mexico and other hot countries to clothe themselves in white garments at all seasons, a custom which might with advantage be adopted in all civilized countries.

Equable Clothing Essential to Health.

A matter of the highest importance is the equable clothing of the body so that there shall not be undue accumulation of heat in certain parts, while other parts are insufficiently protected. The arms and legs, and particularly the feet, require special protection, for the reason that they are farthest from the body, while they present a larger

surface in proportion to their weight and the amount of blood supplied to them than does the trunk. Many persons suffer greatly from insufficient clothing of the limbs in the cold seasons and on cold mornings and evenings, without being aware of the cause of their illness. Congestion of the head, and various disturbances of the stomach and bowels and other internal organs, and especially lung affections, are the result of this neglect. When the arms and the limbs are chilled, their blood vessels are contracted, and some internal part must of necessity be overcrowded with blood, or congested. A state of congestion is always one of weakness and lowered resistance to disease, and is the introduction to chronic maladies and even degenerations and organic changes.

The "rum blossom" of the drunkard is the result of the fact that his nose receives too much blood, and grows too large in consequence. When the liver is habitually overcharged with blood because of chilling of the lower extremities, the result will be to encourage enlargement of the liver and the dropsical and other affections which follow, often to a fatal result. Women are particularly prone to carelessness in this regard, and children are often neglected. Frequently persons whose feet are habitually cold have become so accustomed to this condition that they are quite unconscious of it, and it is necessary to especially call their attention to the fact. The chest and the abdomen require extra protection for out-of-door exercise in cold weather, for the reason that the skin of these parts is much thinner and far more sensitive to cold than the back. This portion of the body is also more exposed than the back, because of the direction in which the body moves.

Useful Hints Respecting the Clothing.

A few "don'ts" in relation to clothing may be found helpful: —

Don't dress the neck too warm when going out in cold weather. A little extra protection is required for the ears, but it is not necessary to muffle up the neck with thick furs to protect the ears. A light scarf or ear muffs are all that is needed. Warm wrappings about the neck cause the skin of the neck to become moistened with perspiration. When the wrappings are removed indoors, the slow cooling which takes place in consequence of the evaporation, chills the parts, and may produce sore throat or nasal catarrh.

Don't wear rubbers indoors, nor out of doors, except when it is necessary to prevent wetting the feet. Rubbers being impervious to air, prevent evaporation, so that the perspiration is retained, and the shoes and stockings become damp from the perspiration. When the rubbers are removed, evaporation chills the feet, the same as though they had been wet by the rain or by walking on a wet pavement. On removing the rubbers after they have been worn for some time, it is a good precaution to remove the shoes and stockings and put on dry ones. If this cannot be conveniently done, care should be taken to keep the feet warm until the shoes are dry. The rubbers should be dried before wearing again.

Don't wear a mackintosh or rubber overcoat, except when necessary; and on removing the waterproof, when it has been worn for some hours, don't forget to change the undercoat also. The clothing is saturated with moisture from the skin, and a chill may be induced by evaporation from the moist clothing.

Don't wear at night underclothes which have been worn during the day.

Don't forget, on going to bed at night, to hang up the underclothing in some place where it will air overnight. It is a good plan to lay the clothing over a warm steam coil when it is convenient to do so. Persons who perspire freely should employ two suits of underclothing, wearing each every other day, allowing one day for airing and drying.

Don't wear more clothing than is really necessary for comfort. Many people render themselves sensitive to cold by wearing too much clothing.

On going out of doors, don't forget to slip on an outer garment of some kind if the temperature is considerably lower than the indoor temperature; especially protect the head and the feet.

Don't wear thin-soled shoes at any season of the year. One may take cold from chilling of the feet as the result of wearing thin-soled shoes in walking over a cold pavement, even when the pavement is perfectly dry.

Don't adjust the clothing to suit the season of the year only, but adapt it to the weather conditions of each particular day.

Don't wear high-heeled shoes, nor pointed shoes, nor narrow-soled shoes, nor tight shoes, nor low shoes. Don't wear slippers, except in the house. Shoes must have broad, reasonably thick soles, plenty of room for the toes, low heels. Rubber heels are a great comfort.

Don't support the clothing by bands tight about the waist.

Don't constrict the limbs by means of elastic bands to support the stockings. Support all clothing from the shoulders, not by bands, but a waist, or the "union" plan.

Common Evils in the Customary Dress of Women.

The generally recognized fact that the average civilized woman is far inferior in strength to the average civilized man is in large part due to the unhealthful and unnatural dress almost universally worn by civilized women. The evils to which we refer are not those which arise from what is termed tight lacing, but those that are due to the ordinary dress that is worn by every civilized woman, almost without exception, who is sixteen years of age or over, and not infrequently by girls at a still younger age. The limits of this volume will not permit of an extended discussion upon the subject of dress. We have space only to notice the chief objections to the common style of women's dress, and to note the methods by which these evils may be corrected.

Waist Constriction.

It is rare to find a woman who will admit that her clothing is too tight, and yet it is equally hard to find a woman whose clothing is not so tight as to do serious damage. Unfortunately, the idea prevails among women that a small, round waist is a mark of beauty and a thing much to be desired. Men probably to a considerable extent entertain this same erroneous notion. The fact is that women naturally have larger waists than men, compared with their height. This is due to two facts: 1. That the stomach, liver, bowels, spleen, and other organs are larger in women than in men of the same size; 2. That women are naturally a little more fleshy than men, and have plumper figures. If a woman has a smaller waist than a man of the same height, it is because she has made it so by an unnatural mode of dress; just as the Chinese women make their feet ridiculously small by

compression, so the American woman makes her waist absurdly narrow in the same way.

The author has measured the waists of a large number of civilized women of different nationalities,— American, English, French, and German, Indian women, Mexican women, Chinese women, Zulu women, Arabian women, Egyptian women, negro women from far up the Nile,— and has invariably found that women who have never been deformed by wearing the clothes which the civilized woman habitually wears, have waists larger in proportion to their height than have men of the same race. The author has taken the pains, also, to measure a large number of ancient models as represented in famous statuary. He finds the same thing to be true. Here are some figures. The circumference of the waist of the Venus de Milo is nearly one half that of the height of the figure, the exact proportion being 47.6 per cent of the height. The following table shows the figures obtained by modern measurements: —

	Per Cent of Height.
French peasant women	45.4
Chinese women	45.4
Average of forty-three American women, eighteen to twenty-five years of age, wearing healthful dress	44.64
Venus de Milo	47.6
Average of two thousand men, eighteen to twenty-five years of age, measured by Dr. Seaver of Yale	42.7
Average of eleven hundred women wearing ordinary dress	39
Apollo Belvidere	45

From the above figures we see that the waist measurement of the Apollo Belvidere is more than two per cent less than that of the Venus de Milo. The waist measurement of two thousand men, measured by Dr. Seaver, is nearly 3 per cent less than that of the average French woman, 3.7 per cent more than that of the average American woman, 2 per cent less than that of the average American woman

when wearing a healthful dress. The proportions of the Venus de Milo, recognized by artists as the finest model in existence, show a waist measurement five per cent greater than that of the average American man. That this proportion is not abnormal is shown at once by a glance at the reproduction of this beautiful Greek statue shown in the accompanying cut.

Some Interesting Observations.

The author is able to produce other evidences of an equally convincing character. Ten or twelve years ago, while visiting the Yuma Indians at old Fort Yuma, in New Mexico, an exceedingly primitive tribe, for the purpose of studying natural proportions, a young Indian woman, twenty-six years of age, who presented herself for measurement, was found to have a remarkably symmetrical and beautiful physique. On measurement, the waist proportion was determined to be 47.6, or the precise measurement of the Venus de Milo. Several years later, while visiting Cairo, Egypt, an opportunity offered for obtaining the measurement of a Nubian woman of about the same age. The waist proportion was found to be precisely the same, while the average waist proportion of a dozen Arab, Egyptian, Zulu, and Nubian women was found to be but a trifle less. The measurements of abnormally fleshy persons were not taken, but none others were excluded.

These facts show beyond controversy that women do not naturally have smaller waists than men, but larger waists, and there are physiological reasons why this is necessary.

At the Battle Creek Sanitarium, which receives every year one to two hundred young ladies into its nurses' training class, it is a constant observation that the waist measurement

increases two or three inches, and often more, when a natural mode of dress is adopted after entering the institution. The waist measurement not infrequently increases four or five inches, and in one case, to the author's knowledge, the increase amounted to seven inches. A similar increase has been observed in the waist measurements of hundreds of lady patients who adopt the new mode of dress on entering the Sanitarium for treatment.

The Deformities of Civilized Women.

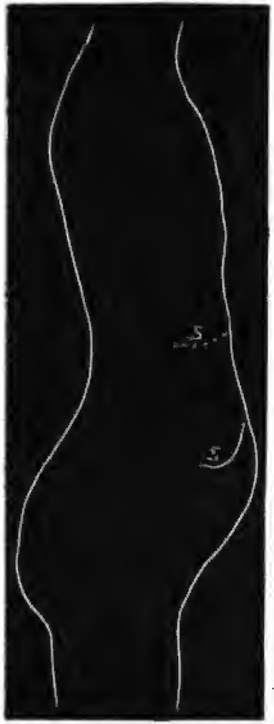
These facts are extremely significant, for they indicate the extent to which the average civilized woman is deformed. Girls of ten or twelve years have an average waist measurement of 23.5 inches. The average measurement of twenty-five young ladies, eighteen to twenty years of age, was found to be 23.3 inches, or one fifth of an inch less than that of girls half as old. There is only one explanation for the fact that the waist of girls does not usually increase after the age of ten or twelve years, while there is a great increase in height and of other bodily proportions, and that is that the waist is so constricted that it cannot expand.

The fashionable dressmaker insists that the young lady's figure must be "*formed*," and so as she develops she grows into a mold, like a cucumber in a bottle. And thus it happens that we find the civilized woman with a waist disproportionately small, as we find among the aristocratic class of Chinese women, dwarfed and misshapen feet. The small-footed woman of China, in consequence of her deformity, is compelled to hobble about in a most ungraceful fashion, requiring usually one or more persons to sustain her in keeping her balance. She cannot run, skip, or work, as can her large-footed sisters. She is willing, however, to

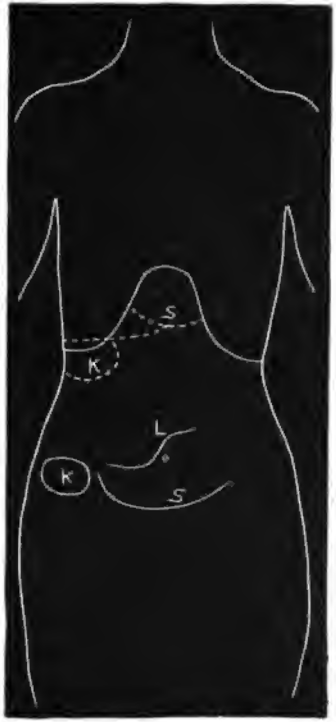
endure the inconveniences of being a cripple and the loss of the use of her feet and legs rather than forego the pleasure of being in fashion. If the sacrifices which the civilized woman makes to fashion were no greater, there would be comparatively small ground for complaint; but the habitual girding of the waist results in mischiefs of vastly greater magnitude than those which the Chinese woman inflicts upon herself.

Savage Fashions.

As the flat-headed woman watches with interest and growing pride the progressive depression of her infant's skull, while from day to day she binds more tightly upon it the flattened disk of wood; and as the Chinese woman glories in the shriveled and misshapen stump of what was once her child's foot, as a developing mark of aristocratic gentility, in like manner does the civilized mother pride herself on the smallness and roundness of her daughter's corset-deformed waist, disregarding alike the suggestions of art, the warnings of science, and the admonition which nature gives in the discomfort and distress occasioned by the effort to secure a change in the natural contour of the human form, which is more monstrous in its violations of the laws of beauty, more widely at variance with the dictates of reason, and more disastrous in its consequences to bodily health and vigor, than any similar barbarity practiced upon themselves or their children by the members of any savage or semisavage tribe. How such a disfigurement of the physique could ever have come to be considered desirable or beautiful, is a problem hard to solve, since it involves not only an enormous loss of strength and vigor, but a violation of all the relevant principles and precepts of

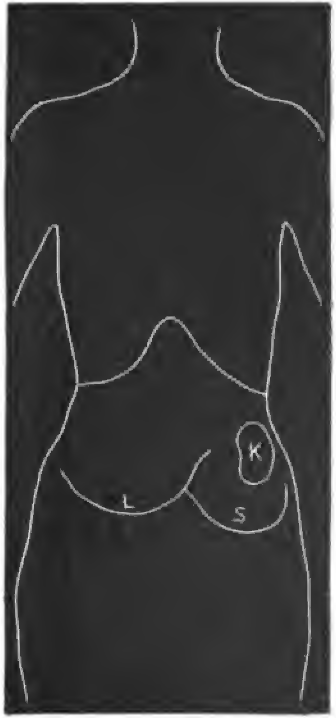


EFFECTS OF A "HEALTH CORSET."



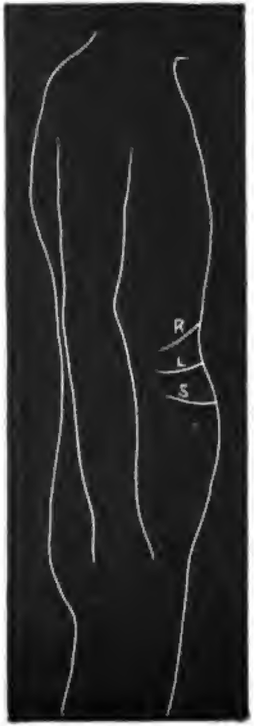
FRONT VIEW OF THE SAME.

EFFECTS OF TIGHT BANDS AND HEAVY SKIRTS.



FRONT VIEW OF THE SAME.

EFFECTS OF CORSET-WEARING AND TIGHT BANDS.



MAN WITH A PROLAPSED STOMACH DUE TO WEARING A BELT.

OUTLINE OF A YOUNG WOMAN WHOSE "CLOTHES WERE NEVER TIGHT."

SIDE VIEW OF THE SAME.

art which have been handed down to us by the great masters, as well as rules of hygiene in which all medical men of every age agree.

The Barbarity of Popular Modes of Dress.

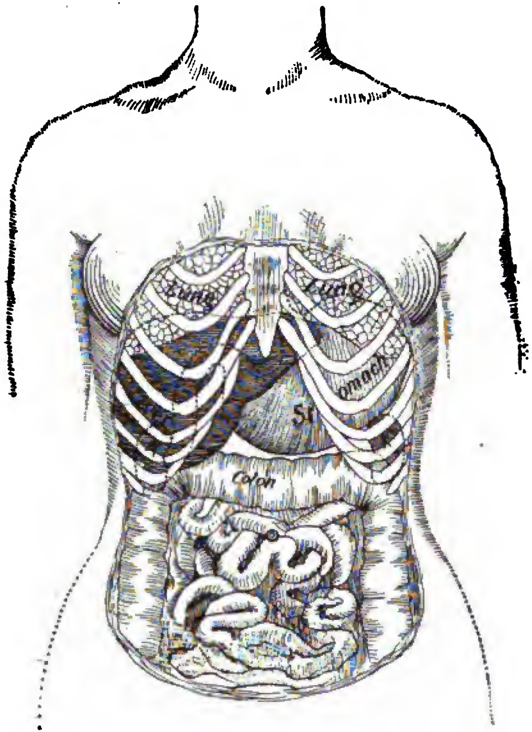
The injury resulting from this waist constriction is not simply an external deformity. The chief evil consequences are those which result from the displacement of the stomach, liver, bowels, kidneys, and other abdominal organs. Numerous important facts in relation to the serious consequences resulting from displacement of this sort have been developed as the result of comparatively recent discoveries and researches. Professor Glenard, of France, for example, has brought out the fact that a great number of chronic diseases of the stomach, liver, and nerves are due to the simple displacement of the stomach and bowels.

Diseases Due to Fashionable Dress.

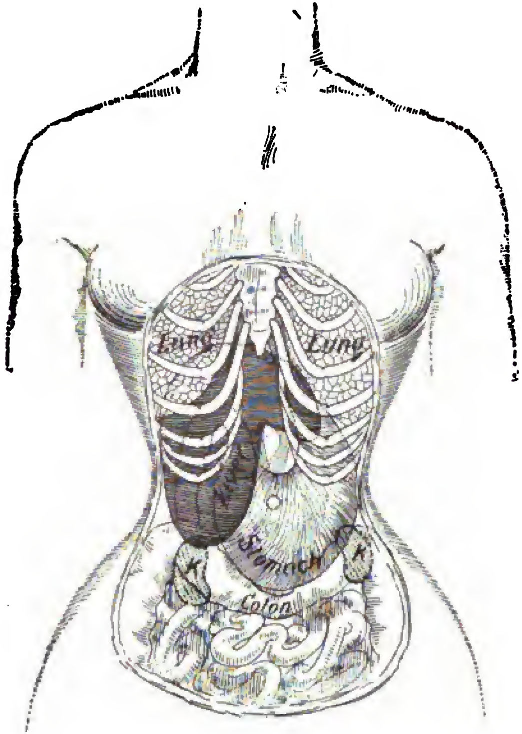
Nervous exhaustion, pain in the small of the back, headache, biliousness, neuralgic pains, heaviness across the lower abdomen, pains in the legs, nervousness, general languor and weakness, inactivity of the bowels, lack of endurance,—these and many more diseases which might be mentioned are the direct outgrowth of the displacement of the abdominal organs such as arises from waist constriction, whether occurring in men or in women. A large share of the illnesses from which women suffer, and which are attributed to peculiarities of sex, result from this mechanical cause alone. The accompanying figures show very clearly the terrible results which may follow even moderate constriction of the waist, such as the average woman considers no constriction at all. Please note that in the normal state the liver, stomach, pancreas,

spleen, and the greater part of the colon lie above a line connecting the lowest ribs. These important organs occupy the upper part of the abdominal cavity, in the very center of the trunk. These organs are chiefly supported from below by the pressure of the abdominal muscles, being attached above only by thin membranous bands, which may easily be stretched by continuous pressure or traction to a very considerable degree.

In an accompanying illustration is shown the effects which actually resulted from the compression of an ordinary dress. This lady was certain that she had never worn her clothing tight. She had never intended to, her clothing was always comfortable; but both her kidneys were found floating, and they had fallen several inches below the ribs, her stomach had fallen nearly to the umbilicus, the colon was lying still lower down, and the patient was in an exceedingly wretched state as the result. It is not necessary that the waist should be greatly constricted that these effects should result. Pressure of the belts just tight enough to prevent expansion of the waist in breathing will ultimately result in pushing the important organs which lie above the waist downward to the extent of several inches. This result is produced by the expansion of the lungs in deep breathing. In coughing, lifting, singing, or as a result of deep breathing induced by exercise, the diaphragm forces the stomach and other organs downward. When there is opportunity for the waist to expand, the additional room required for expansion of the lungs is obtained by separation of the ribs, allowing a lateral expansion of the abdominal space; but when this expansion of the lower part of the chest is prevented by belts, bands, tight waists, or a corset, the stomach and other organs must be crowded downward below their



THE INTERNAL ORGANS IN NORMAL POSITION.



THE INTERNAL ORGANS DISPLACED BY WAIST CONSTRICTION.

a

b.

c.

d.

a. b. c. EXERCISES TO CORRECT STANDING POSITION.

CORRECT SITTING POSTURE.

normal position; and a frequent repetition of this action finally results in prolapse of all the organs which occupy the upper part of the abdominal cavity. It is no more possible for a dislocated stomach to perform its functions properly than for a dislocated hip to serve its proper purpose. In fact, dislocation of the hip or knee is a much less serious injury, and likely to effect the general health far less injuriously than dislocation of the stomach or liver or kidneys.

Effect of Waist Constriction upon the Kidneys.

The author some years ago was obliged to remove a kidney of a woman in whom the organ had become displaced in this manner. It had become so diseased that it was the seat of a large abscess, containing a stone weighing four ounces, an evidence of the injury caused by the ordinary mode of dress. This lady had never knowingly constricted her waist, but had worn the ordinary dress, which, while not intended to constrict the waist, allows no room for expansion in breathing.

In actual waist constriction (see cut) the consequences are, of course, still worse, and are very rapidly produced. Extreme waist constriction not infrequently causes still more dreadful deformities of the liver, which interfere with its function. It is possible, even, that the liver may be cut in two. The author has met two cases of this sort. A German surgeon was obliged to open the abdomen of a woman, and remove a large portion of the liver which had been cut off by constriction of the waist, and had become gangrenous.

Displacement of Vital Organs Due to Waist Constriction.

Prolapse of the stomach and bowels naturally results in displacement of the organs which lie in the lower cavity of the trunk. These displacements are far more common than

is generally known. The author recently made a careful examination respecting the position of the stomach, liver, and bowels in fifty working men and seventy-one working women, all of whom were in ordinary health. In the seventy-one women examined, prolapsus of the stomach was found in fifty-six cases. In nineteen of these cases, the right kidney was found prolapsed, and in one case, both kidneys. The fifteen cases in which the stomach and bowels were not prolapsed were all persons under twenty-four years of age. None of these had ever laced tightly, and four had never worn corsets or tight waistbands, having always worn the clothing suspended from the shoulders. It is noticeable that in a number of cases in which corsets had never been worn, tight waistbands had produced very extensive displacement of the stomach, bowels, and kidneys. In one of these the liver was displaced downward.

Men Suffer as Well as Women.

In the fifty men, the author found only six in whom the stomach and bowels could be said to be prolapsed. In one, the right kidney was prolapsed. In only three was the degree of prolapse anything at all comparable with that observed in the women, and in these three it was found, on inquiry, that a belt or something equivalent had been worn as a means of sustaining the pantaloons. In another case the patient very properly attributed his condition to the wearing of a truss furnished with a belt drawn tightly about the waist.

From the above facts it appears that prolapse of the abdominal organs was found present in eighty per cent, or four fifths (four out of five) of the working women, all of whom considered themselves in ordinary health. Prolapse

of the stomach, but considerably less in degree, was found in only one of every eight men examined. From this it appears that prolapse of the stomach and bowels is about six times as frequent among men as among women. The reason is not far to seek. Prolapse is produced in men, as in women, by wearing belts instead of suspenders to support the clothing. A military officer who was under the author's care several years ago had a floating kidney which was the result of the constriction of the sword belt. He had been in the habit of carrying a heavy sword for many years. In the case of a blacksmith in whom a floating kidney was found, it was due to the practice the man had of tying his leathern apron strings tightly about his body while shoeing horses. In both these cases the patients were suffering much pain and distress because of the condition of the kidney, but were wholly oblivious to the mischief which had been done by the practice of girding the waist. Such are not rare among men, although by no means as common as among women.

Crippled Breathing.

The crippled condition of respiration in a woman whose waist is constricted by a corset or tight bands, is clearly shown by the readiness with which such a woman gets out of breath when called upon to make unusual exertion, or when there is a special demand for lung activity from any other cause. The first thing done for a fainting woman is to cut her waistbands and corset strings; but no one would ever think of tearing open a man's vest or slitting up his shirt front under the same circumstances.

The proper action of the chest may be aptly compared to that of a pair of bellows. The lower ribs, to which the strong breathing muscles are attached, serve as handles.

The breathing apparatus of a woman whose waist is constricted by a corset or tight bands, is nearly as much embarrassed in its action as would be a pair of bellows with the handles tied together. The clavicular respiration, so conspicuous in women who constrict the waist, is not seen among savage women, nor in a woman whose respiratory organs have not been restricted in their action by improper clothing.

In natural breathing, the action is chiefly at the waist, although the entire trunk wall and every organ within the trunk participates in the movement. The action begins with expansion, first the sides, and then in front, finally a slight elevation of the upper chest, and, in forced respiration, a slight drawing in of the lower abdomen at the same time with the chest elevation.

It is thus evident that, in its interference with the proper respiration, as well as from the mechanical injuries which it inflicts, the common mode of dress, which involves constriction of the waist, is the most potent means of impairing the health and vigor of the whole body, and may be justly reckoned as perhaps the greatest of all factors in the general decadence in physical vigor so apparent among women of the present day.

Why Woman Is "the Weaker Vessel."

That there has not been a general rebellion against this unnatural and mischief-making mode of dress on the part of the intelligent women of this enlightened age, is probably due to the popular but fallacious idea which seems to be so thoroughly fixed in the minds of both men and women, that woman is "the weaker vessel," and naturally subject to ailments and weaknesses and general physical inefficiency

from which men enjoy immunity. Any one who has made himself familiar with the activity of the women of savage nations, or even the women of the peasant classes in civilized countries, must have recognized the fallaciousness of this popular idea, which had its birth in the age of chivalry, and has come down to us along with numerous other fancies and superstitions which have no foundation, either in natural experience or physiological science.

The average civilized woman is certainly very much inferior to the average civilized man in physical vigor. The constancy of this observation has led both the profession and the laity to regard woman as naturally weaker than man. But that this is not necessarily so, is shown by the constant experience and observations of travelers among uncivilized tribes. Travelers in China are often astonished at the immense loads which Chinese women carry upon their shoulders. Some years ago the author saw a woman in the market place at Naples, Italy, carrying off upon her head an immense load of vegetables, which required two men to lift into position. De Saussure relates that when he had finished his observations in the valley of Zermatt, he packed a collection of mineralogical specimens in a box, and called for a porter to carry it out of the valley, as the mountain roads were too steep to be traveled by four-footed animals of any sort. After a fruitless search for a man who was able to transport his box of specimens, he finally was told that if he wished a porter to carry his package, he must employ a woman, as no man could be found who was able to even lift the box. He accordingly engaged a woman who offered herself for the purpose, and stated that she carried the heavy box of minerals over the steep mountain roads without the slightest injury either to it or to herself. Stanley reports that

the two hundred women porters whom he employed on one of his expeditions proved to be the best porters he ever had in Africa.

When in England, a few years ago, the author made an expedition into the "black country" for the purpose of studying the women brickmakers and nailmakers of that region. He found at Lye some of the finest specimens of well-developed women he ever saw anywhere, women who had spent all their lives in brickyards or before the forge, swinging the blacksmith's hammer, and making the anvil ring. These women never go in out of the rain for fear they will get wet and take cold, and although working in mud and water a great share of the time, have no other protection for their feet than shoes, often full of holes and almost without soles, and wholly inadequate to protect the feet from water. They are constantly engaged in lifting heavy weights. One woman was seen tossing and kneading upon a block a mass of clay, which by actual test weighed over sixty pounds. She handled it in her hands as though it were only a small mass of dough; and although thus employed from early morn till late at night, she was in no way injured by her occupation.

Why Many Women Suffer.

Most invalid women complain of pain when on the feet, dragging pain in the bowels and the lower portion of the back, pain at the extreme lower end of the spine, soreness and pain in the region of the navel, a feeling of lack of support in the lower abdomen, a sensation commonly described as "goneness" at the pit of the stomach, weakness of the lower limbs, pain in the back, crawling, tingling, numbness, stinging, and other sensations in the legs, cold hands and

feet, burning of the soles and palms. Sometimes the patient says that when on her feet she is only comfortable when holding up the bowels with the hands. Such patients tenaciously cling to the corset because they evidently need some support. These patients also often complain that when they undertake to stand without a corset, there is such a sinking at the stomach that they are compelled to sit down. The evident cause is the dragging of the prolapsed bowels and stomach occasioned by the relaxation of the abdominal muscles, by which the branches of the pneumogastric and sympathetic nerves are put under an unnatural strain.

"Health corsets" are a device of the devil to keep in bondage women who are seeking for deliverance from the weakness and misery from which a really healthful mode of dress might emancipate them. Shoulder braces and harnesses of every description are on the whole a snare and a delusion. The only correct principle is to suspend everything from the shoulders by means of a waist which will equally distribute the weight upon natural bearings, and at the same time give latitude for the greatest freedom of waist movement.

The Ordinary Mode of Dress Inartistic.

Neither a proper knowledge of the requirements of the body nor a just consideration of the principles of beauty justifies the popular mode of dress. The idea that a small waist or a round waist is beautiful, is a mischievous and dangerous notion which ought to be eradicated from the public mind. God never made a waist round, slight, or tapering, as though it were chiseled out of a block of wood; and why should we allow ourselves to be persuaded by the fashion mongers to regard as beautiful a thing which from an artistic standpoint is truly hideous, monstrous, and repulsive? An

artist who should make an undraped figure with the waist modeled after a French corset, would not be allowed to exhibit his work in any respectable gallery.

We see in the enormous busts and bustles which fashion prescribes, an evident attempt to cover up by means of these excrescences the uncouthness of form which the corset and other fashionable modes of torture have induced, and by their aid to approach as far as possible to the ideal figure, which, in its native grace and beauty, requires no such accessories.

The Far-reaching Mischief from Errors in Dress.

A careful study of the accompanying figures will assist in fixing in the mind the terrible damages to the body resulting from an unnatural mode of dress. Women are not the only sufferers. The sons of the mothers whose constitutions have been weakened by the following of customs in dress, are born with feeble vitality and little power to resist disease. This must be regarded as one of the causes which is operating to produce the rapid race deterioration which we see going on all about.

Healthful Dress a Moral Obligation.

When men and women recognize the body as a sacred temple given them to care for as a most precious treasure, the first question which is asked in relation to dress will not be, "Is this garment in fashion? Is it the latest style?" but, "Will it answer the demands of modesty and protection without in any way interfering with any bodily function?" The wearing of a dress which in any way deforms the body or interferes with any vital process, is a sin against Heaven, is nothing more nor less than a defacing and profanation of the

temple of the Most High. For a woman to undertake to improve upon the handiwork of God by changing the shape of her body regardless of the effects upon those delicate and marvelous organs which are placed within the trunk, and in which daily and hourly miracles of creation and transformation are wrought in carrying forward the various processes of life,— for any person to presume to improve upon the masterpiece of the Great Artist which he himself pronounced very good, is an affront, an insult to the Creator. It is a duty which every woman owes to herself, to the race, and to God to thoroughly inform herself upon the question of healthful dress, and to lay aside at once and forever all waist-constricting bands, corsets, belts, and other trammels, and to clothe herself with such garments as shall be thoroughly in harmony with physiology and common sense.

Fortunately, this is not at the present time a difficult thing to do, for patterns and instructions for making healthful garments may be easily obtained, and many healthful articles of apparel may be purchased ready-made. Such great advances have been made in this line within the last few years that a woman may now clothe herself as healthfully and conveniently as a man, perhaps even more so, if she desires so to do, and may accomplish a thoroughgoing reformation without rendering herself to any extent whatever an object of ridicule or even of comment, unless it be by the improvement in physique and in grace of bearing, in freshness and cheerfulness of countenance, and in general vigor and healthful of appearance. A little better plan is to have the upper and lower garments made in one piece, "union suits."

There are now to be found in all the large centers dressmakers who understand the principles of healthful dress-

making. There are many firms which make a specialty of manufacturing healthful garments of various sorts, also patterns, by the aid of which any dressmaker or skilled needle woman may construct garments for women and girls, which are thoroughly in harmony with physiological principles. The publishers of this work will be glad to give the addresses of such firms, with other useful information to any who may apply to them by letter for the same.

In conclusion we would remark that a woman who desires to make a thoroughgoing reform in dress must also undertake a regular course of body development whereby her general physique and bodily shape may be improved. A good figure and a graceful standing poise is essential to the good appearance of a healthful dress. How this may be acquired will be pointed out in the next chapter.

How to be Strong.

THE muscles and the bones constitute together the machinery, the levers, by which the body is moved about, and movements of all sorts executed. Every muscle is a living machine, every bone is a lever or a fulcrum which some muscle or group of muscles uses in doing work. Five hundred pairs of voluntary muscles act upon two hundred bones in performing the different kinds of work the body has the power of doing.

Two Kinds of Muscles.

Besides the voluntary muscles, which constitute about half the bulk of the body, there are also involuntary muscles, muscular structures which act independent of the will, in numbers too great to be even estimated. The skin is a perfect network of little muscles. Every hair has a minute muscle attached to it by which it may be made to stand erect. The stomach is a muscular sac. The intestine is a long, muscular tube. The air tubes of the lungs have muscular walls. There are muscles in the spleen and other internal organs. The heart, the great pumping engine of the circulation, is a wonderful muscular structure.

All these muscles, voluntary and involuntary, contract under the influence of nerves. The voluntary muscles are the servants of the human will, and enable it to execute its purposes. The marvelous skill of hand shown in piano playing, in drawing, and in various arts, the soul-stirring tones of the orator, the musical notes of the soloist, all are depend-

ent upon the action of muscles. This is equally true of a large part of all the experiences of life. Those sudden changes of the face which constitute what we call expression, are due to the play of delicate muscles which by their action pull the skin of the face about, this way and that, as may be necessary to express a mental state or a moral sentiment. Without the voluntary muscles, man, if he could live, would be quite unable to express his thoughts or feelings, or to communicate them in any way.

The two sets of muscles, voluntary and involuntary, very forcibly call our attention to the two wills existing within the body, which seem each to have its special set of muscles to carry out its orders. The human will controls, if not absolutely, to a large degree, the movements of the large groups of muscles which clothe the bones and help to form the walls of the trunk and chest, the voluntary muscles, while the involuntary muscles, acting wholly independent of the human will, are controlled by the so-called automatic will. What is this automatic will? Let us see what it does for us.

The Services Rendered the Body by the Muscles.

While we are asleep, as well as when we are awake, the automatic will maintains the never-ceasing rhythm of the heart and lungs. When we take food into our mouths, after we have chewed it and passed it to the back part of the throat, through the direction of the automatic will the muscles of the esophagus seize it and carry it to the stomach. Under the same control, the food is acted upon by the muscles of the stomach walls, passed into the intestines, and in due order moved along from point to point until it has been acted upon by the various digestive fluids, and absorbed

and converted into blood to nourish the various organs of the body.

Thus it appears that in the digestive process the food is moved along from one stage to another by means of muscles; we breathe by means of muscles; the blood is circulated, and the blood supply to each particular part regulated by means of muscles; these muscles are all under the control of a will which never sleeps, which acts intelligently, which does its work with absolute fidelity and loyalty to the well-being of the body, even when the conscious will is working against the body's interests. Do we not plainly see in this beneficent intelligence which so constantly and efficiently works in carrying forward the most important vital movements and activities of the body, the evidence of that in-dwelling Presence which, while not man, makes man His dwelling place, and becomes his servant in performing for him those wonderful offices which man cannot perform for himself; patiently laboring for his up-building, though he through ignorance breaks down the bulwarks of his energy and strength; which still serves in supplying man's increasing needs while he foolishly, even wickedly, squanders his God-given vitality and power? "Ye have made me to serve with your sins." What divine humility is this! Man the master, God the servant even when man chooses to make a wrong use of his God-given energies!

How Muscles Act.

It is of more importance for us to know how muscles act, and the relation of muscular activity to the important functions of life and of the body in general, than to know the particular names of individual muscles of the body, or of the bony prominences to which they are attached.

When a muscle acts in obedience to the will, it is by shortening, or contracting. As it shortens, it at the same time thickens, but the most remarkable changes which occur in a muscle are invisible to the eye. When the muscle began contracting, it may have been pale; but as it begins to work, its arteries dilate, and fill with blood, for it is the blood that brings to the muscle the energy which it requires for work. A working muscle is warmer than one at rest, for the reason that muscular contraction is always accompanied by the formation of heat by the burning up of some of the material which is stored in the muscle and brought to it in the blood.

Fatigue.

When any large group of muscles, for example those of the legs, are set in active operation, as in jumping or running, one becomes very quickly out of breath. This is a species of fatigue. It is due to the fact that when the muscle is at work, it throws into the blood which passes through it a large quantity of carbonic acid gas, which is poison to the body, and must be hastened out through the lungs. The greater the amount of this gas thrown into the blood, the quicker one becomes out of breath, and the more rapid and urgent the breathing movements. Under the influence of active exercise the lungs are expanded to their utmost capacity by strong chest movements, which are made without voluntary effort, for the process of breathing is under the control of the higher will. The breathing movements induced by vigorous exercise are deeper than those that can be induced in any other way, because they are executed in obedience to an imperative command from the nerve centers through which the automatic will controls the lungs.

If the exercise is less violent and continued for a longer time, one may not get out of breath, but after a while the muscles will become wearied, so that movement is difficult, and may become impossible. This fatigue, or exhaustion, is due, not to the using up of the supply of energy with which the muscles are stored, but to the production of certain poisonous substances which result from the muscle work, and which have the effect to paralyze the muscle. If one rests for a time, the sensation of fatigue will disappear, the fatigue poisons having been washed out by the blood. The fatiguing exercise may now be repeated.

Secondary Fatigue.

After very prolonged and violent exercise, especially exercise to which one has not been accustomed, one may find himself suffering from muscular soreness, stiffness, together perhaps with great lassitude, and even fever, if the exercise has been very violent or prolonged. These symptoms do not generally appear until some hours, perhaps a day or even longer, after the exercise producing them. This is known as secondary fatigue.

The fatigue induced by a short period of exercise is very quickly recovered from, possibly disappearing within a few minutes. The longer and the more arduous the work performed, the longer the period of rest required for recuperation. Exertion may be carried to such a point that death may result from the fatigue induced. Runners have sometimes dropped dead at the end of a long course. Horses have been known to die suddenly from the same cause, also dogs when attempting to follow their master on a long and fast bicycle ride. Carrier pigeons not infrequently fall to the

ground dead from exhaustion after a long and rapid flight. In such a case the death is due to the rapid accumulation of the fatigue poisons formed by the overacting muscles. Fatigue may be said to be always a condition of poisoning, whether it be local or general fatigue.

It is interesting to note that exercise of a portion of the muscles may give rise to general fatigue. For example, one's arms become tired as the result of running, although not to any extent actually employed in the exercise.

The brain and nerves are also wearied as well as the muscles by prolonged muscular work. It is important to note the fact that one is more likely to become fatigued when performing exercise to which he is not accustomed. When he becomes used to the work, it can be done with less fatigue, or perhaps none at all, and the smaller amount of carbonic acid gas produced shows that the work done by the muscle is less.

Mental work requires much less food than does physical labor. Recent careful experiments which have been made, show that men engaged in active mental labor and abstaining from muscular exertion, require practically no more food than men at rest. This is a fact of very great importance for students, ministers, and other professional men whose occupation does not require any considerable amount of effort, since the taking of food in excess of that which is required results in the filling of the blood with poisons, and in consequence crowding of the tissues with tissue wastes and poisonous matters which interfere with all the bodily functions, and especially with the functions of the brain and nerves. Mental activity is clouded, sleep may be prevented, and all the effects of nervous exhaustion produced by a comparatively

slight expenditure of energy, giving rise to languor, sometimes depression, and at other times irritability, confusion, and indecision of mind, even moroseness and melancholy.

The condition of lethargy produced by excessive eating or habitual drunkenness must be distinguished from fatigue due to work. Persons in this condition often decline to exercise because they "feel so tired." This state of lassitude and enervation cannot be overcome by rest. Carefully graduated exercises and regulation of the dietary are the proper remedies. There are many chronic invalids whose sufferings and disability are wholly due to this cause, and who may be readily restored to usefulness by a spare and simple dietary combined with outdoor exercises, gradually increased in vigor and duration as the strength improves.

Persons whose habits are sedentary are very much subject to secondary fatigue. As we have already learned, one fourth of the food eaten, or two thousand five hundred food units, should be consumed by muscular work. A sedentary person consumes in work only one tenth part of the food eaten, or eight hundred food units, leaving the remainder to accumulate in the body in the form of unused material, provided the same amount of food is eaten. This would give rise to an accumulation of fat at the rate of about one pound a week; but after a time the limit of useful fat accumulation is reached, so that no more of the reserve material can be properly disposed of in this way; if the same quantity of food is still taken, the tissues are flooded with imperfectly burned material. If meat, milk, eggs, or other albuminous foods are used in considerable quantity, uric acid and other similar poisons accumulate in the muscles. Such a person on taking exercise, even though it may be very small in amount, suffers

extremely from secondary fatigue. A slight cold, or any unusual digression in diet, such as is likely to occur on Christmas or other holiday occasions, may increase the amount of tissue poisons to the extent of provoking an attack of rheumatism or gout.

The soreness and stiffness which accompany secondary fatigue usually disappear in a few days, and unless the exertion has been exceedingly violent, so that the parts used have been strained or otherwise injured, the muscles are stronger than before, and able to endure more work, and the same exercise may be repeated without injury. The soreness and stiffness which follow the first attempts with any new form of exercise or any unusual amount of exercise, should not discourage one, but should be regarded as an indication that nature is preparing the muscles for better service by strengthening the muscular fibers and storing up a larger amount of energy.

Those who have not been accustomed to active exercise generally manifest a very great reluctance to engage in vigorous or prolonged muscular effort of any sort. The fatigue experienced is disagreeable, more or less distressing, perhaps; but perseverance will work such a change in the muscles and in the whole body as to make active muscular exertion a pleasure and a delight instead of a disagreeable task. All animals delight to work. A healthy child can with difficulty be restrained from almost constant activity when awake. Man is naturally constituted to be the most agile, enduring, and active of all the members of the animal creation.

A Day's Work.

The amount of work which can be performed by the whole body is much greater than one would naturally sup-

pose. The human body is in fact one of the most perfect working machines in existence. It makes more economical use of the food taken into it as fuel than does the most improved form of locomotive. The body is able to utilize one fourth of its food-fuel in energy, three fourths going to the production of heat, whereas the most economical steam engine ever constructed can utilize only about one sixth of the energy of the fuel, five sixths being wasted as heat.

The total strength of all the muscles in the body of a very strong man, as shown by the dynamometer, an instrument by which muscle strength is tested, is about ten thousand pounds. The strength of the average healthy man is about two thirds as much, or, we may say, six thousand pounds. Of course no person can lift a weight of 10,000 pounds. The figures given represent the sum of all the lifts, pushes, and pulls which the various groups of muscles of the body can execute. The anatomist knows each of the five hundred pairs of voluntary muscles by name. This great number of muscles is divided into about thirty groups, but for our purpose we may simplify still more, and divide the muscles of the body into five groups,— those of the legs, arms, trunk, chest, and back.

It is interesting to note something of the relative strength of these several regions of the body. The strength of the legs is almost exactly one half that of the entire body, and twice that of the arms; so the strength of the arms is about one fourth that of the whole body. The combined strength of the trunk and the chest equals that of the arms. The strength of the average woman is about one half that of the average man.

Exercise and Respiration.

We have already learned that exercise, especially very active effort, greatly accelerates the breathing movements, and increases the depth of respiration. At first the breathing is slightly difficult, but after a short time, when the runner has his "second wind," respiration becomes easier, due to the fact that the entire lung surface has been brought into action by the complete distention of every part of the lungs. This fact has in it an important lesson, namely, that in ordinary breathing the entire lungs are not brought into use, and hence are likely to become diseased unless brought into full and active movement by taking daily such exercises which necessitate deep and full respiration. Such exercises should be taken several times a day.

Running or rapid walking in the open air is the best means of securing the necessary lung capacity. If this is not convenient, however, the same results may be secured by exercise taken indoors with doors and windows widely opened so as to secure free ventilation. It is not even necessary to run about the room. One may "run in place," executing the movements of running by throwing the weight first upon one foot and then upon the other, lifting backward the foot which is not in use. Various other exercises may be employed to excite the lungs, but active movements of the legs are on the whole of the greatest service. Very rapid running, carried to the extent of extreme breathlessness, is likely to be injurious to persons who have passed the age of twenty-five years. So-called "sprinting" is injurious to the heart, and in time leads to other injuries. The deep breathing induced by running continues for some time afterward. Those who habitually walk or run much,

or who engage in mountain climbing daily or several times weekly, breathe deeper even in sleep than do persons of sedentary habits, and in consequence introduce into their bodies a larger amount of oxygen, and live on a higher plane physically, than do others.

Exercise Assists Digestion.

Exercise aids digestion by creating an appetite, promoting the secretion of the digestive fluids, and increasing the peristaltic movements of the intestines. When God said to Adam, "In the sweat of thy face shalt thou eat bread," the command was given to the entire race to engage in active muscular labor. Those who seek to avoid sweating, or who neglect to take habitual active exercise, are punished by ill health. The apostle Paul said, "If any will not work, neither let him eat." Nature says the same by removing the desire for food or the power to digest it. The inactive man who is still able to eat and digest, runs great risk from the accumulation in his body of unnecessary or unused material, which clogs the vital machinery and fills the blood with poisons whereby its resistance and that of the body are diminished. Nature takes away the appetite and lessens digestive vigor to avoid this danger. When an idle or sedentary man throws away this protection by stimulating the palate by means of condiments and a constantly renewed variety of stimulating foods, he is working at cross purposes with God, and will certainly suffer the penalty of disobedience.

Thus we may see that the wise man uttered a profound physiological truth when he declared, "By much slothfulness the building decayeth." Eccl. 10:18. The body temple is worn by work, but is at the same time renewed, so that work is a means of constant body change or renovation.

The value of a brisk walk on a cold, frosty morning in developing the appetite for breakfast, is well known by every one. Life out of doors may be justly regarded as one of the most important means of promoting health and securing sound digestion and proper assimilation of the food. Exercise also aids digestion by promoting activity of the bowels whereby the body rids itself of waste matters, lack of attention to which may result in chronic poisoning, a condition from which thousands constantly suffer who might find complete and entire relief by the simple means indicated.

Exercise quickens the stream of life, increases the action of the heart, lungs, stomach, liver, and every vital organ; and by cleansing away the rubbish which accumulates in the tissues as the result of work, prepares the way for new material, and so is one of the greatest of all means of promoting life and health. All examples of extraordinary longevity which have been reported have been of persons who had led active, even laborious, lives, and whose habits in diet and in other respects were simple and regular.

Muscular Development.

The development of the muscles themselves, though not the greatest of the advantages derived from active and regular muscular exercise, is a very important advantage gained. The general increase in bodily vigor which accompanies increase in muscular development is an important aid in combating the enemies of life with which we are continually surrounded. Strong muscles indicate a strong heart, for exercise of muscles necessarily develops the heart. A strong heart secures vigorous circulation and an ample supply of blood to every part.

Muscles differ from all machines of human construction

in the fact that they grow stronger with work, at least until a maximum development has been secured. Certain individuals show a remarkable capacity for development. Dr. Winship, for example, by systematic practice acquired the ability to lift two thousand eight hundred pounds; and St. Cyr, a Canadian, surpassed this extraordinary feat by nearly a thousand pounds; but both of these men died prematurely, having derived no real benefit from the extraordinary, perhaps, one may say, destructive development of their muscles. The possession of strong muscles, however, is an immense advantage in every trade or profession, and in all the walks of life, furnishing a background of vigor and energy which is a vital capital of inestimable value.

The vigorous development of the muscles of the trunk is of even greater importance than the development of the arm and leg muscles. The development of the muscles of the chest is essential to the healthy action of the lungs. Development of the abdominal muscles is necessary to maintain the abdominal organs in their position and to assist in breathing. Strong back muscles are especially necessary to maintain a healthy poise of the body, which is essential to healthful lung action, and to the healthy action of all the organs of the chest and abdomen. The neglect to develop the muscles of the back leads to weakness of the respiratory and abdominal muscles and to various bodily deformities, external and internal, such as flat and hollow chest, round shoulders, spinal curvatures and twistings, and displacements of the various internal organs. These deformities are in part the result of abnormal attitudes, and in women are largely due to improper dress, which by constriction prevents the proper action of the muscles of the trunk. It will be well for us briefly

to consider here some of the most common deformities and the best methods of correcting them.

Round Shoulders and Flat Chest.

This is one of the most common of deformities. The two conditions, flat or hollow chest and round shoulders, go together. A round-shouldered person is one who is simply carrying his chest behind instead of in front of him. This deformity is not necessarily indicative of a weak chest or small lungs, but rather of weak back muscles and the habit of sitting in a stooped or relaxed position. This habit naturally results from much sitting at study, writing, the keeping of accounts, and similar occupations. Most persons who sit much, or whose employment naturally tends to a stooped position, are round shouldered. This condition is nearly as common among farmers whose occupation is chiefly out of doors, as among clerks, students, and business men, because of the careless habit farmers have of sitting in a stooped position in driving or when resting from active work. Even athletes are not infrequently very round shouldered. This deformity not only gives a person a weak and ungraceful appearance, but lessens the breathing capacity, and leads to inactivity of the upper part of the lungs, thus inviting consumption and other diseases, which arise from the lodgment of germs in contact with inactive and weakened portions of the lung tissues.

Persons who have flat chests or round shoulders should sleep on a hard mattress, on the back if possible, with a very thin pillow or none at all.

Correct and Incorrect Sitting Attitudes.

When a person sits with the chest flattened, and the shoulders rounded, the muscles of the trunk are relaxed.

The breast bone, or sternum, and the ribs are depressed in front, and the result is a pushing downward of the stomach, liver, and other abdominal organs. The abdominal muscles are relaxed so that they afford no support to the viscera, and the certain consequence is congestion. Sooner or later, serious disease of the liver, stomach, bowels, and other abdominal organs is certain to appear.

When one sits erect, as shown in the plate, the chest is elevated, the abdominal muscles are drawn in, the internal organs are held up in their proper positions, and the movement of blood through these organs is active, and their functions normally performed.

The correction of an improper position in sitting, and the cultivation of an erect attitude, with full, deep breathing, will be found in itself sufficient to cure many a backache, sideache, headache, and a considerable part of the indigestion, heaviness, and the accompanying distresses from which multitudes suffer, and for the relief of which quantities of nostrums are swallowed in vain. A proper sitting position is of the highest importance as a means of correcting this deformity. Parents and teachers should admonish the children under their care to " sit tall," to reach their heads up as high as possible, and should take the advice to themselves.

In sitting, the seat should be of the proper height, so that the feet may be squarely placed upon the floor, and supported without undue pressure upon the under side of the leg. When the lower extremities hang over the edge of the chair, the blood circulation is interfered with, the nerves are pressed upon, and the limbs become numb and cold, or "go to sleep," to use the common expression. To avoid this discomfort, the occupant of a seat which is too high slips forward and reclines in his seat. This is an exceedingly bad

position, resulting in relaxation of all the muscles of the trunk, and extreme flattening of the chest.

It is well to bear in mind that one should never lie down when sitting up, but should maintain an erect position. The chest should be well raised forward, and the abdominal muscles well drawn in. To do this will at first require attention and an effort. One must every few moments correct his position. After a while the habit of correct sitting will be acquired, and great advantages healthwise will thereby be gained.

One of the obstacles to assuming and maintaining a correct position in sitting is a weak, over-stretched condition of the muscles of the back. Correct sitting is a splendid exercise for these muscles, but certain exercises aid greatly in developing them. It is worse than useless to say to a round-shouldered person, "Put your shoulders back." The proper thing to do is to instruct him to *put the chest forward.* His shoulders will then naturally fall back in the effort to balance the body. The shoulders may be put back without in the slightest degree correcting the deformity.

The correct standing position is shown in the accompanying plate. This position is easily acquired by a little practice. The improvement in health and personal appearance is so great as to make it worth while to make the effort to obtain a good poise and graceful carriage. First of all, it is necessary to get a correct idea of the erect position. With the aid of a teacher, this can be acquired in a few minutes. Having no teacher, one may employ a wall as a trainer.

Standing against the wall, facing the center of the room, place the heels, hips, shoulders, and back of the head firmly against the wall. Reach the arms downward as far as possible, holding them to the sides with the thumbs turned out-

ward. The door, or the side of a doorway, is more convenient than a plastered wall, as there is no baseboard.

While keeping the heels and hips against the wall, bend the head backward as far as possible, keeping it also in contact with the wall, and pushing the shoulders and chest forward as far as possible. Holding the chest in the forward position which it has reached, raise the head forward, draw in the chin, taking care not to allow the chest to fall or the shoulders to come in contact with the wall. If this movement has been executed correctly, the proper standing position will be acquired. By noting the " feeling " given by this position, one may easily be able to instantly assume it without the aid of a wall.

Exercises to Promote General Health and Development.

As before remarked, there is nothing better than labor for promoting muscular development and securing the advantages which come from exercise. But care should be taken continually to keep as nearly as possible in a correct poise. Ignorance, carelessness, or weariness often leads a person to assume awkward and unhealthful positions while engaged in work, which, in consequence of the irregular muscular development thereby induced, become fixed deformities. It should also be remarked that some employments give undue exercise to special muscles, and this leads to deformities. A carpenter, blacksmith, or cabinetmaker may be generally known from other artisans by the way in which they carry their arms. The strongly developed flexor muscles overbalance the extensors, so that the arms are constantly bent when at rest as well as at work.

For children, out-of-door play, light work, assisting in cultivating small fruits, doing chores, and similar occupations

are the very best kinds of employment. Elderly people require a considerable amount of exercise, but should carefully avoid violent exercise of all sorts. They should especially be careful not to become greatly overtaxed, or not to become greatly out of breath. The chest wall being rigid, the lungs cannot expand as in youth, and the heart may also be easily overworked. Elderly people who are accustomed to exercise do not so quickly experience a sensation of fatigue because of diminished nervous sensibility. They are consequently very liable to overwork, not being aware of the fact until a day or two later, when the symptoms of secondary fatigue appear. It is very important that elderly people should understand this fact, which applies to mental as well as physical work. An elderly man may be able to compete with a young man in exertion without apparent injury at the time, but will later suffer, while the young man will experience no injury, though at the time greatly exhausted.

Women as a class suffer more than do men in consequence of lack of exercise. Their exercises must be less violent than those of men, as they have but half the muscular strength, and are less accustomed to vigorous muscular exertion. Breathing exercises are especially important for women and aged persons.

Running exercises are not to be recommended for adult women nor for persons past middle age. Boys and girls of twelve to eighteen years of age may run until quite fatigued without injury. Their hearts and lungs are sound and not easily damaged. Adults, unless from youth accustomed to running, must content themselves with a very slow pace, and should avoid exercising until extreme breathlessness is produced. The pulse and the respiration should return within a few minutes to the normal rate. When the pulse

remains quick for half an hour or more after exercising, this fact is evidence that the exercise has been too violent, and must not be repeated until the body has been trained.

Elevation of temperature, as shown by the thermometer, after moderate exercise, as a walk of a mile or two, is a symptom which should receive immediate attention, as it indicates a possible beginning of tuberculosis of the lungs. Exercise should never be taken by a person who has fever. Persons who are just recovering from an attack of typhoid or other acute febrile disease should begin exercising very carefully indeed, as there is great danger of producing a relapse. Even sitting up will cause an elevation of temperature in a recent fever convalescent.

The Amount of Exercise Required.

A working man, as we have learned, may perform work equivalent to lifting nine hundred tons a foot high in a day. It is not probable, however, that so much work as this is required for the maintenance of health; but it has been calculated that at least one fourth of this amount of labor, or work equivalent to walking nine miles, should be done daily by the average man in order to maintain normal and proper vigor and activity of the lungs and heart, and of the various functions which depend upon the action of muscles. It should be remembered, however, that the strength, health, and vigor of the internal muscles, those of the stomach, intestine, and bladder, as well as those of the heart, depend upon the strength of the external muscles. When the external voluntary muscles are weak, the internal muscles become weak also. There is known to be an association through the nerves of the muscles of the abdomen with those of the stomach, such as accounts for these effects. In the exami-

nation of hundreds of patients, the author has observed that those patients who have extremely dilated stomachs have extremely weak abdominal muscles. The maintenance of strong and vigorous external voluntary muscles must then be regarded as directly related to the health of the important organs of the trunk upon which maintenance of life primarily and immediately depends.

Exercise may be classified as gentle, moderate, and violent. Gentle exercise is that which does not produce either fatigue or breathlessness. Moderate exercise produces fatigue when sufficiently long continued, but not breathlessness. Violent exercise produces breathlessness, which is one form of fatigue; and if continued for any length of time, produces exhaustion. Gentle exercise is adapted to invalids and very feeble persons. Violent exercise is permissible only to young persons and adults who have been accustomed to vigorous exercise all their lives. Moderate exercise is the sort which is especially indicated for health in all classes. It must not be considered, however, that exercises are harmful that cause a person to breathe deeply. Deep breathing is one of the most beneficial effects derived from the exercise.

Estimation of the Work Done in Taking Exercise.

The total amount of work which may be done in a day by an ordinary laboring man is about equal to the lifting of 1,800,000 foot pounds, or lifting nine hundred tons one foot high. This is equivalent to lifting a hundred-ton weight a foot high thirty times a minute during ten hours. A man could not accomplish this with his arms alone, but by employing both his arms and his legs, this enormous amount of work, and even more, may be accomplished. Indeed, the body has such a wonderful capacity for work that it is pos-

sible for a strong man to put forth the enormous amount of effort above indicated in a fraction of a day by taxing his energies to the utmost in such violent exercise as a rowing contest.

It is sometimes useful to make calculation of the amount of work which one performs in a given exercise. For example, in such a simple exercise as walking, the amount of work done is much larger than would be supposed. At each step, the body is lifted about one and one-half inches. Allowing two and one-half feet for each step, eight steps would cover a distance of twenty feet. In taking these eight steps, and raising the body one and one-half inches at each step, the body would be raised in all just one foot. It thus appears that the amount of effort required to walk twenty feet on a level surface at the rate of three miles an hour is just the same as would be expended in lifting the body perpendicularly one foot. The same amount of work would be accomplished if one should walk ten feet and at the same time ascend a grade at the rate of six inches to ten feet, or a trifle more than half an inch to the foot.

Let us suppose the amount of work which a person is capable of doing in a day is equal to the lifting of 1,800,000 pounds one foot high. This is the amount stated by eminent authorities to be the average day's work of which the body is capable. Let us determine how far a person would have to walk in order to perform this work in lifting his body along a horizontal surface. Supposing the weight of the person to be one hundred and eighty pounds, dividing 1,800,000 pounds by one hundred and eighty, we learn that it would be necessary to lift his own body ten thousand feet in order to do the required amount of work. If the work done in walking twenty feet is equivalent to lifting the body

one foot, the distance to be traveled to do the required amount of work will be obtained by multiplying ten thousand by twenty, which equals two hundred thousand feet. Dividing this by 5,280, the number of feet in a mile, we have thirty-eight miles as the distance to be traveled. If the journey involved the ascent of a mountain five thousand feet in height, the required distance would be only one half as great, or nineteen miles. By similar calculations it is easy to determine the amount of work done in traveling either on a level or in climbing hills or mountains, provided the distance traveled and the altitude ascended are accurately determined. The amount of work done may be increased, of course, by carrying a burden of any sort. If, for example, a man weighing one hundred and eighty pounds should carry in addition to his own weight a burden weighing ninety pounds, the distance traveled would be proportionately less (1,800,000 divided by 270 equals 6,666). It is thus apparent that a very fat person will accomplish a larger amount of work in traveling a given distance than a person of less weight.

The body is always at work. The heart and lungs do work amounting to much more than one hundred foot tons during twenty-four hours. The simple acts of sitting or standing require expenditure of energy. Rapid walking may more than double the energy expended in a given time, and in running, the amount of work accomplished may be several times as much as that performed in walking at the rate of three miles an hour.

Ordinary slow walking involves very little muscular exertion for a person in ordinary health. When the rate of walking is increased to five or six miles per hour, the amount of muscular work involved is considerable. Walking at the rate of three miles an hour is equivalent to lifting the body

perpendicularly through one twentieth of the distance walked. For example, if a person walks one mile at the rate named, the amount of work done would be equivalent to lifting the body perpendicularly through a distance of 264 feet (5,280 divided by 20 equals 264). If the distance traveled has been along a rising surface, the elevation attained must be added to the work done. For example, if a person in traveling a mile has ascended a hill one thousand feet high, the total amount of work done would be equivalent to lifting the body 1,000 plus 264 feet, or 1,264 feet. Suppose the person's weight to be 150 pounds, the amount of work done would be 1,264 times 150, or 189,600 foot pounds, or nearly the same amount of work which would be done by walking five miles on a level surface.

If a hill or a mountain is not available, ordinary stairs may be utilized most advantageously. In going up stairs one is obliged to lift the body through the distance from the lower floor to the floor above. Suppose the distance to be ten feet, and one's weight to be one hundred and seventy pounds. Going from the lower story to the upper would involve an amount of work equivalent to lifting a little more than one ton a foot high. To do a day's work, that is, to lift one hundred and fifty tons, the person would have to ascend the stairs about one hundred and fifty times, taking no account of the small amount of work involved in descending the stairs.

The work can be accomplished, if desired, by means of exercises which can be readily taken in one's own room; as, for example, in such exercises as standing erect and alternately raising and lowering the heels, or flexing and extending the knees, or supporting the body upon the hands between

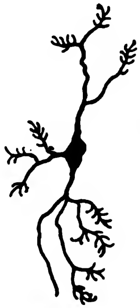
two chairs or other supports, and letting the body down as low as possible, and then raising it to position,— the so-called "dipping" movement. In the last-named exercise the work is done by the arms.

To do one hundred and fifty foot-tons of work, a man weighing one hundred and fifty pounds would have to walk forty thousand feet, or about seven and one-half miles, at the rate of three miles per hour (300,000 divided by 150 times 20, equals 40,000). The same man practicing heel raising at the rate of one hundred movements a minute, for sixteen minutes, rising two inches each time, would do as much work as in walking a mile (150 times one-sixth times 16 times 100, equals 40,000).

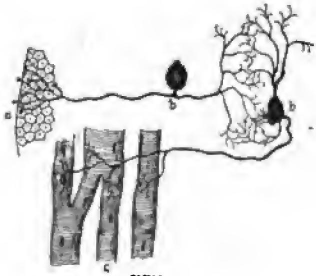
He would have to continue the exercise for two hours to lift his one hundred and fifty foot-tons. As this would make the legs do all the work, it would be better to divide the work between the arms and the legs. This may be accomplished by making the arms assist, by resting the hands upon the back of two chairs, the foot of the bed, a table, or any other convenient support, and making a downward push with the arms each time the heels are raised.

A larger amount of work may be done in the same time by lifting a pair of iron dumbbells with the arms at the same time the heel-raising movements are executed. For example, a person weighing one hundred and fifty pounds, holding in his hands a pair of dumbbells weighing twenty-five pounds each, making the total weight lifted two hundred pounds, raising himself two inches thirty times a minute, would do work amounting to 1,000 foot-pounds each minute, or 60,000 foot-pounds in an hour.

If at each movement, a pair of dumbbells weighing ten



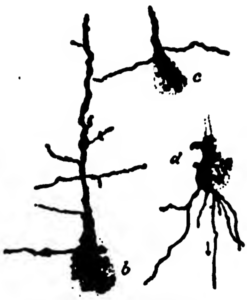
A NEURON, OR NERVE-CELL



(a) SKIN
(b b) NERVE-CELLS
(c) MUSCLE

NORMAL NERVE-CELL SHOWING POINTS OF CONTACT

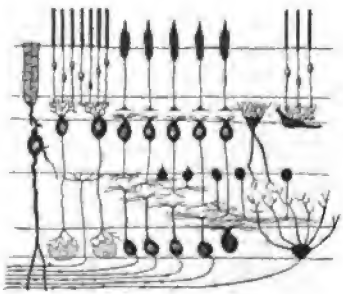
NERVE-CELL IN ACUTE ALCOHOLISM



APPAEARANCE OF NERVE-CELL IN CHRONIC ALCOHOLISM

CONTRACTED NERVE-CELLS CONTACT BROKEN

A PURKINJE'S CELL



NERVE-CELLS OF THE RETINA

ABDOMINAL COMPRESS.

HEATING COMPRESS.

COLD COMPRESS OVER THE HEART.

HEAD COMPRESS COVERED BY MACINTOSH CAP.

pounds each are raised one foot, the additional work thus done would amount to 21,600 foot-pounds for the hands. The combined work of the arms and legs would be thirty-nine foot-pounds for each movement (162 divided by 6 plus 12, equals 39). It is only necessary to divide the total work to be done, 300,000 foot-pounds, by 39 to determine the number of times the movement must be executed (300,000 divided by 39 equals 7,700). At the rate of twenty movements a minute, the work could be done in a little less than six and a half hours.

By combining knee-flexing movements with the arm-flexing movements and the heel-raising movements, the required work can be accomplished in a shorter time, although the greater length of time required for the execution of the movement lessens the advantage. For example, a person weighing one hundred and fifty pounds, first raising his heels, then bending his knees, and returning to position, raising and lowering his body about fourteen inches in so doing, would perform work equivalent to lifting his entire body one foot in the same length of time. Executing these movements at the rate of sixteen times a minute for two hours and five minutes, would be equivalent to walking eight miles, or a day's work of one hundred and fifty foot-tons, for a person weighing one hundred and fifty pounds.

The Brain and the Nerves

THE brain and the nerves constitute the means through which man the creature comes closely in touch with God the Creator. The brain and the nerves together constitute the seat of the mind, the consciousness, the will, the thinking, feeling, governing organs.

The brain and nerves are commonly described separately as independent organs, but in reality they are one. The thinking and feeling organ, as the whole together might be called, centers in the cranial cavity, but occupies the whole body. The smallest brain conceivable is a minute mass of transparent material, of irregular shape, and so small that several hundred ranged in line would make a row only an inch long. The scientific name of such a structure is a nerve cell, or neuron.

A neuron consists of a body with elongations or branching parts. One of these branches is commonly very greatly elongated, often to the extent of several inches, ending in a delicate tuft. The accompanying cut gives a representation of a typical neuron. Nerve cells have many different forms. A very interesting branching form is presented in the cut. Every cell of this sort is a center of nervous activity, a seat of intelligence, a source of energy, a living battery in which energy is generated, or rather in which the energy derived from the food is set free, and made to appear in vital work.

The mass of matter within the cranium that we call the brain, is simply an assemblage of these little brains, comprising in all the enormous number of more than 100,000,-

000,000. Similar cells are found in all parts of the body,— in the heart, the lungs, the stomach, the liver, in the walls of the blood vessels, in the skin. Their prolonged branches constitute the nerve trunks, and serve to connect the cells in different parts of the brain, and of different parts of the body, and especially to connect the central brain with the lesser brains and various other organs of the body. The number of these cells and fibers in the body is so great that if all other structures were removed,— the skin, bones, blood vessels, muscles, etc.,— nerve fibers and cells only being left, the form of the body would still be absolutely complete and solid in appearance, so that our thinking and feeling organs, that is, the brain and nerves, really occupy the whole body, just as do the circulating organs, the heart and blood vessels.

It will be interesting to notice a little more carefully the structure of a neuron. It consists of a body with a nucleus, or center, and branches, which may be very few or exceedingly numerous. A careful examination of the branches shows that they are covered with minute buds. It is supposed that these buds are for the purpose of contact, either directly or indirectly with other cells. This contact occurs by means of the tufts which form the ends of the long, branching filaments. The cell branches, as well as the matter composing the center of the cell, consist of transparent, jelly-like matter as clear as water, yet possessed of the most marvelous and varied properties of any known substance. By means of these living threads, which are many times smaller than the finest spider web, the nerve cells, or little brains of the different parts of the body, are in constant communication with one another, just as various points and cities of a country are in communication by means of telegraph and telephone wires.

The nerve cell is the battery; the nerve fiber, the wire. Who is the operator?

Feeling Cells and Working Cells.

There are various sorts of nerve cells or brains. Two different classes may be recognized; cells which feel, or receive impressions, and cells which send out impulses to organs which are capable of doing work of various kinds. The cells of feeling, or so-called sensory cells, comprise many different groups, each of which is the seat of some particular kind of sensation, of which we may enumerate the following so-called special senses: sight, hearing, smell, taste, touch, pressure, weight, temperature, and various general sensations, as pain, hunger, nausea, thirst, fatigue, the sense of suffocation, and others.

The nerve cells, or rather groups of cells which have control of vital work, are too numerous to name, for every acting organ in the body down to the smallest muscle fiber or the most minute gland cell, is stimulated to action by impulses received from nerve cells or groups of cells. Bodily movements of every sort, although performed by muscles, originate in the nerve cells which control the muscles. Nerve cells arranged in groups, called centers, in the brain and spinal column, likewise control the work of the liver, the stomach, the kidneys, the lungs, the heart, even every individual blood vessel and sweat gland. Special centers are provided to control such acts as coughing, sneezing, vomiting, defecation, emptying the bladder, the dilatation and closure of the pupil, the balancing of the body, the heat-making processes, speech, and writing.

These various centers are located in different parts of the brain. The cells which are the seat of feeling, voluntary

action, and consciousness, are found upon the surface of the brain; those which are especially concerned in conscious mental acts are apparently located in the front part of the brain; those from which impulses go out to the muscles are in the middle portion; and those which receive impressions from the eyes, ears, nose, and from sensory organs, occupy the lower and back part.

The Basal Ganglia.

At the base of the large brain are found some very interesting groups of cells which serve as middlemen, receiving impressions or orders from the large or upper brain, and transmitting them through the spinal cord to the organs for which they are intended. Acts which are performed very frequently, as in walking, piano playing, swimming, and the special acts peculiar to the various trades, are for the most part carried on by means of these intermediate centers, which, after a certain amount of training, seem to be able to conduct habitual acts without any conscious effort on the part of the higher centers. For example, a person in walking does not have to give thought to each individual step; he only resolves to walk, and consciously regulates the rate at which he walks, directing the movement, but the walking apparently goes on without any special effort of the will. This is quite true, however, only when a person walks at his habitual gait. To walk much slower or much faster than the usual pace requires a constant conscious effort. Writing is at first an extremely laborious act, which requires very close and conscious effort to direct the muscles employed. The accomplished penman, however, is able to write rapidly, and without giving conscious thought to the exact formation of the individual letters. He only thinks

the word he wishes to write, and the hand produces it under the control of these subordinate ganglia. This is true also of typewriting, of speech, of piano playing, and of every habitual act.

How Habits Are Formed.

It thus appears that the formation of a physical habit involves the education of a portion of the brain; and when the habit has once been formed, the act may be performed almost independently of the will or the higher brain. This fact should impress us most profoundly with the importance of forming right habits, since it is apparent that the getting rid of a wrong habit involves not only the formation of a right habit, but the far more tedious and difficult work of undoing the evil work which has been done in the wrong education of the brain. This same principle applies to the higher centers which are concerned only in mental acts, as we shall see later. It is indeed a most momentous thought that every act of our lives not only emanates from the brain, but modifies and changes the brain, thus influencing our characters.

Reflex Nervous Action.

Farther down, in the canal of the spine, there are located other groups of nerve cells or centers which perform special kinds of work. A frog without a head may be made to jump by pinching the skin of his back. It jumps with its spinal cord, showing that there is personality still present. The body is sometimes paralyzed by injury to the spinal cord at its upper part. In such a case, if the sole of the foot is tickled, the leg will be drawn up, showing that the spinal cord controls the leg, independent of the brain to a certain degree.

When the hand comes in contact with a hot object, it is instantly drawn away. One does not have to reflect, "My hand is in contact with something hot; it is likely to be burned, so I had better draw it away." The hand is pulled away at once before there has been time for thought or consideration. Actions of this sort are called reflex, and they are of immense importance in protecting the body from injuries of various sorts. Even during sleep the reflexes are still active, drawing up the foot when the sole is lightly touched, or pulling away the hand if pricked. That these reflex movements are independent of the will is shown by the fact that the time occupied is much less than that required for a voluntary movement. The time required for a person to give a signal in response to a touch is about one eighth of a second. This is called the reaction time. The reaction time of a reflex movement is less than this.

The eyelid is closed when the eyeball is touched, another illustration of reflex action. The acts of winking, swallowing, sneezing, coughing, and vomiting are reflex. All these are protective movements, and may be set in operation so vigorously as to make voluntary suppression impossible. Sneezing, for example, is for the purpose of discharging some offending object from the nose; coughing, for removing some object from the air passages; vomiting, to empty the stomach of some offending material.

Since the will does not control these so-called reflex movements, we may well inquire who does control them? How are they controlled?

Automatic Nervous Action.

Even during the most profound sleep, some of the centers of the spine remain in active operation. For instance,

if the temperature of the room rises too high, the vessels of the skin become dilated, and perspiration pours out for the purpose of cooling off the blood which has been slightly overheated. This action takes place without the slightest voluntary direction; nevertheless, it is an intelligent and purposive action of the most important and beneficent sort. If, on the other hand, the temperature of the surrounding atmosphere falls, perspiration will be lessened, the skin vessels will contract, and chill, which consists in vigorous muscular contraction, may take place, although the individual is sound asleep, unless he is awakened by the shivering. Here again is an intelligent and important operation performed without conscious effort. The beating of the heart and movements of breathing are carried on during sleep with the same regularity and the same adaptation to bodily needs as during the waking state. For example, a rise in the temperature of the room will hasten respiration and the heart beat, while a lowering of the temperature will produce the opposite effect.

These intelligent adjustments of the bodily machinery are evidences of a purpose as definite and positive as that which dictates the movements of the hand in placing an object to the mouth, in directing a pen or a pencil, or in any other voluntary movement. These movements are not prompted by the human mind, they are not regulated by the human will, for they occur during the most profound sleep, when the mind and will are in abeyance. Intelligence and purpose are displayed, but they are not of the human order. They are above it. They are the evidence of a mind that comprehends all and provides for all, of a will that never slumbers nor sleeps. "Behold, he that keepeth Israel shall neither slumber nor sleep." Ps. 121:4.

The Sympathetic Nervous System.

The sympathetic nervous system consists of a double chain of small brains or ganglia found within the trunk of the body and extending from the brain to the coccyx. The thirty-one pairs of sympathetic brains are connected with one another and with the brain and spinal cord by numerous branches. They also send out branches to all the organs of the body, to every blood vessel, even the most minute, and to every gland.

Small sympathetic ganglia extend through the body, in the walls of the intestines and the blood vessels, and every vital part. The sympathetic nervous system is closely associated with the brain and spinal cord, and is really a part of the general nervous system, not an independent system, as was once supposed.

The sympathetic or organic nervous system has a most intimate connection with all the organs concerned in digestion and nutrition. They also influence the action of the heart and the blood vessels. Through controlling the blood supply, they control the functions of every organ in the body, even the brain.

Through these wonderful structures the various organs of the body, even those the most remote, are sympathetically associated, a fact referred to by the apostle Paul: "And whether one member suffer, all the members suffer with it." 1 Cor. 12:26. How clearly this fact is illustrated in every-day experience! Disturbance of the stomach disturbs the brain; weariness of the brain paralyzes the digestive process. The action of the lungs and heart is often disturbed, likewise, by disorders of the stomach, producing asthmatic breathing or palpitation of the heart. Headache, pain in various parts, coldness of the knees and

feet, flushings of heat in the face and other parts, are other examples of sympathetic disturbance connected with a disordered stomach.

Consciousness — Intelligence.

Conscious mental activity is the most wonderful of all the functions of the brain. How do we think? From whence do thoughts come? Does the brain make thoughts, as the liver makes bile?

Mind must be regarded as one of the manifestations of life. Every living form gives evidence of design, of creative thought. How could the sunflower know which way to look to find the sun without direction? How could the little duckling with a hen mother learn to swim without a teacher? How could the carrier pigeon find its way home without a guide?

The perplexities in relation to mind are largely the outgrowth of a false philosophy, which recognizes as the foundation of all existence two classes of things, natural and supernatural, physical and metaphysical, material and spiritual, matter and mind. This classification is absolutely artificial, and has led to all sorts of confusions and theological mysticisms. Intelligence is one of the forces of the universe, one of the manifestations of the all-pervading life which created and creates, animates and sustains.

Intelligence, like gravitation and magnetism, is universal. Every object which can recognize the force of gravitation has weight. Every object which can recognize and manifest the magnetic force is a magnet. The brain is an organ so constructed that it is able to manifest intelligence. Many fantastic theories have been developed respecting the fancied influence of one mind upon another, or so-called thought

transference. All these involve gross errors. Thought cannot be transferred from one mind to another, but two human brains far apart may receive a kindred idea at the same moment, not because one brain is influenced by another, but because both are at the same time in touch with the universal mind.

There is but one original, universal, all-knowing, all-controlling intelligence. The human brain is an organ so constructed that it is able to manifest intelligence. The human will to some extent directs the intelligent operations of the brain, and enables an individual to determine the direction in which his intelligence shall be manifested, whether it shall be applied for good or for evil, whether it shall operate in opposition to the divine will or in harmony with it. The operations of the human intelligence are as unfathomable to human wisdom as are all other of the bodily functions. There is no process known to man whereby food can be converted into blood except by the divine alchemy of digestion. Deep within the recesses of the gray mass of cells and fibers, which is called the brain, intricate and subtle processes are taking place that result in the production of ideas which come into the field of consciousness already formed. Who can make ideas to order? Every one recognizes the fact that ideas come to him from somewhere outside of his own consciousness. Says one, "A good idea came to me recently," or "A thought struck me just now."

Every-day experience shows us that there are intellectual operations taking place within us of which we are unconscious. For example, a problem — social, business, or religious — troubles us. We cannot solve it, and lay it aside for the time being. A few hours later, or some days later, the same problem presents itself again, and with a satis-

factory solution. We are not conscious of having spent any time whatever in weighing the question, but all the points involved have been carefully arranged in proper order to show their proper relation one to another, and the difficulty which we experienced has disappeared. Thinking has been done outside the consciousness.

The only explanation of the mysteries of the varied intellectual processes is the operation of a divine, ever-present, all-pervading Intelligence. The one explanation of Nature which makes every mystery clear, is God, who both creates and maintains, who made all things and operates all things.

The Windows of the Mind.

It requires no argument to demonstrate that a large share of our ideas at least originate in pictures made upon our brains by impressions which are received through the several senses. The material thus received from the outside world might be called the mind food or "thought-stuff." We may profitably spend a little time in the study of these several avenues to the mind, and of the nature of the material which they bring in.

Sight Pictures.

The eye is a picture-making instrument, very much like an ordinary photographer's camera, only much more delicately and perfectly constructed. The eye of an ox recently killed may be prepared in such a way that one can clearly see the picture which is formed by the lens of the eye upon the dark curtain stretched across the back of the eye globe. Just in front of the colored screen is a fine network of nerves and nerve cells which are connected with the brain. In some way which no physiologist has ever been

able to explain, a record is made of this picture in the cells of the brain; and a most remarkable fact which remains to the present moment, and probably always will remain, wholly unexplained, is that while the picture in the eye is upside down, yet the brain sees the object right side up and in its proper relations. The reversal of the picture in the eye is due to the fact that the eye is a lens, and is subject to the laws which govern lenses of glass or other material. In order that the image at the back of the eye should be right side up, a complicated system consisting of several lenses would be required instead of the simple, though delicate, construction with which we are enabled to see; and the mystery of the transmission of the image from the eye to the brain is so great that it is not increased by the reversal of the image.

Most ingenious human inventors have labored for many years to solve the problem of the transmission of a picture through a telegraph wire. Success has at last crowned their efforts, and the result is an exceedingly delicate mechanism known as the telautograph, or the telepantograph. But here we have the same thing accomplished, apparently without any mechanism whatever, simply a bundle of minute white threads running from the brain to the eye, and spread out in a thin, transparent membrane over the screen upon which the picture is formed.

One looks at an object; it may be the face of a friend, a beautiful flower, a strange animal, a collision of vehicles in the street. The next day, or many years after, the picture may be mentally reproduced, showing that a record has been made in the brain. Yet it cannot be supposed that there are pictures in the brain, for the most minute microscopic examination shows no trace of either pictures or

any mechanism upon which pictures could be made. Some curious experiments, however, have seemed to show that when one recalls vividly any object which he has seen, a picture of the object is simultaneously reproduced in his eye. One observer even claims to have taken a photograph of such a picture.[1]

This view may or may not be true, but we know that it is true that in the mind, at least, we may often reproduce in a most distinct and accurate manner eye pictures which have been formed years before. It is related that a famous artist once reproduced from memory a copy of an inaccessible picture hanging in a gallery in a distant city, which was so like the original that it could not be distinguished from it. This is what the brain is doing all the time.

How Eye Pictures Are Formed.

Another interesting and remarkable fact in relation to eye pictures is that, instead of being painted upon the eye by the sun's rays as in the case of the chemically prepared grass or paper of the photographer, the picture is bleached by destruction of the coloring matter of the screen where the rays are focused, producing a picture in white. This necessitates the constant reproduction of the coloring matter of the eye. In other words, a new screen must be prepared for every new picture that is formed. Just as one having made a chalk picture upon a blackboard, must efface the picture made before another one can be drawn, as otherwise the lines would be mixed and the pictures indistinct, so the eye picture must be effaced before a new picture is formed.

Here we are again brought in contact with an intelligence, a power which, fortunately for us, reaches far beyond the

[1] *Popular Science Monthly*, September, 1896.

human will, that operates beneficently and incessantly while we are awake and making use of our eyes, but wholly outside the consciousness. During every waking moment, yes, during every moment of our lives, a master artist stands on duty in every eye, animal as well as human, taking note, copying, one might say, and transmitting to the brain and recording there every picture made, and instantly preparing the picture-making apparatus for the taking of another picture, not by rubbing off the picture, as when chalk is effaced from a blackboard, but by producing anew, creating from the blood, new coloring matter, and filling in upon the living curtain every bright line, every light or hazy spot, that another picture may be received. So rapidly is this work done that it is possible for one to form a clear, distinct picture of a new and separate object eight times a second. If objects are presented too rapidly, the image formed is blurred, for the picture of one is not completely finished before the next is formed, so that several pictures blend together.

The images of very bright objects which have been gazed at for some time, remain long upon the retina, as may be recognized by a single experiment. After looking for a moment directly at a window through which the light is shining brightly, turn the head away from the window, and tightly close the eyes. After waiting for a few moments, a distinct image of the window will be seen, perhaps of a different color, but the form and the outlines of the sash will be readily made out. Sometimes even the fine tracery of a lace curtain may be readily seen with the eyes tightly closed. Certain diseases and various drugs have the effect to greatly lengthen the duration of these eye pictures, thus

interfering with the vision. Tobacco in particular has this effect, also alcohol.

Sound Pictures.

The ear, like the eye, is a means by which impressions are made upon the brain which have a definite form or value, but differing altogether from the pictures received through the eye. Though less intricate in appearance than the eye, the ear is no less wonderfully made. How the great variety of air movements which constitute noises of every possible description, and musical notes covering a range from eight vibrations a second to more than forty thousand vibrations per second, or about a dozen octaves, can be received by nerves and transmitted to the brain, each preserving its own particular quality and quantity, is still an unfathomable mystery, after hundreds of years of study of this interesting organ.

Across the lower end of the canal of the ear is stretched a membrane, which vibrates like the head of a drum when beaten. Inside, a number of curious little bones are arranged on a plan similar to that employed in the sounding instrument of the telephone for magnifying sound. There are also arrangements for lessening the intensity of sound when it is too loud. Most wonderful of all is the musical instrument of the ear, the organ of Corti, which resembles both a harp and a piano keyboard. The musical instrument of the ear is provided with more than twenty thousand strings or fibers, each of which has its particular function to perform in connection with the function of the ear.

During sleep, the eyelids are closed. It seems, in fact, necessary that the eyelid should be closed in order that

one may sleep; but the ears are never closed. The nerves of the ear remain active during sleep, reporting to the brain as during the hours of waking, every audible sound. The sounds or noises to which one is accustomed do not prevent sleep, however, although the impressions brought in through the ear are not infrequently recognized with sufficient distinctness to be woven into dreams, often in a most curious and realistic way. Unusual sounds, or those which have been habitually associated with alarm, generally cause awakening, even when other loud sounds of a familiar character cause no disturbance. Thus the ear is an ever-wakeful sentinel, an avenue to the mind which is never closed, a wonderful evidence of the Creator's never-ceasing protective care.

The Sense of Smell.

In the upper part of the nasal cavity of each side of the nose is a minute yellowish patch, scarcely an inch square in all, in which are distributed nerves which recognize odors. The number of different odors which can be recognized is almost numberless; but, curiously, no one has yet been able to classify these different sensations, or to designate them otherwise than by the names of the objects with which they are connected.

The sense of smell recognizes only minute particles brought to it by moving air. Substances when dissolved in water cannot be smelled, even though brought in contact with the olfactory nerves.

The smelling apparatus is so exceedingly simple that it is impossible to understand how such a variety of sensations can be recognized by it. It is reasonable to suppose that every different odor finds special nerves adapted to its recognition, just as the ear contains special nerves for dif-

ferent musical notes, and the eye special nerves for different colors.

The nose, like the ear, is an ever-wakeful sentinel. A person may be awakened by a strong odor, as of ammonia, or any strongly disagreeable scent.

The sense of smell is perhaps the most abused of all the senses. Those neglects by which the nose becomes the seat of chronic catarrh, may lead to entire loss of smell by destruction of the mucous membrane, or obstruction of the air passages by accumulating secretions, or by thickness of the mucous membrane, so that the odorous particles carried by the air cannot come in contact with the nerves of smell. The use of tobacco destroys the sense of smell by producing disease of the mucous membrane and paralyzing the nerves. The use of snuff and cigarette-smoking are especially destructive to this useful sense.

The sense of smell seems to be so nearly extinct in man, as compared with lower animals, that its value is very largely lost. In the dog, and in some lower animals, the sense is so acute that it appears to be of greater service often than the sense of sight. The sense of smell when normally acute renders exceedingly valuable information of the quality of the air we breathe, warning us of the entrance of poisonous and irrespirable gases, and of the proximity of decomposing matter, which may be a prolific source of germs. The keenness of the sense of smell, as in the case of other senses, when its warnings are neglected, is rapidly lessened, so that it no longer gives notice of the presence of danger. This is well illustrated by the sensation experienced on coming into a close, warm room, as, for example, an unventilated bedroom or a crowded assembly room, after a walk out of doors. One is surprised that the persons in the room can tolerate

the terrible odor easily recognized as present in the room.

This principle applies to both the physical and the moral instincts. If the promptings of conscience are not heeded, they after a time cease, so that one experiences no compunction in doing that, the very thought of which would previously have given alarm. Thus the tolerance of evil may so change us in time that we cease to be able to recognize evil as such.

The Sense of Taste.

Besides the ordinary sensations of touch and pain, there are four special sensations which are recognized by the tongue; these are sweet, sour, saline, and bitter. Bitter is most distinctly recognized at the root of the tongue; the other flavors are most accurately recognized at the tip and sides of the tongue. It has been proved that each of these flavors is recognized by a special set of nerves. The flavor of many substances is often more due to the odor which they emit, and which is recognized by the sense of smell, than to any characteristic properties which are recognized by the sense of taste. An onion, for example, has scarcely any flavor at all when eaten with the nose closed, or by one who has a hard cold. The same principle applies to numerous food substances. A person whose sense of smell is destroyed has much less appreciation of the fine flavors of natural foods than does one whose olfactory sense is intact.

The Proper Function of the Sense of Taste.

The chief use of the sense of taste is in combination with the sense of smell to inform us respecting the qualities of food, and to assist us in gauging its quantity in accordance with our needs. When one is hungry, or has an appetite,

almost every sort of wholesome food may be eaten with relish. When the sense of hunger is satisfied, we cease to relish the same substances which a short time before were most agreeable, and may even loath them.

The sense of taste, combined with the olfactory sense, was doubtless intended as a perfect guide to man in his eating, as is still apparently the case with the lower animals. In order that this should be the case it is necessary, however, that the sense of taste should be natural, and that it should have opportunity for exercise. Nerves of taste which have been abused by the use of pepper, mustard, and other condiments, cannot recognize the delicate flavors of natural food, and are not ready to respond to those delicately balanced reflexes by which the body gives notice when a sufficient amount of food or drink has been taken. Such a perverted taste may, however, be educated so that it again becomes normal, and is able to perform this function, so important to nutrition. It is absolutely necessary, however, that food should be taken very slowly. It should be eaten in a dry state, so that it may be chewed for a sufficient length of time to enable the saliva to dissolve and set free its natural flavors, so that by contact with the nerves of taste, they may notify the stomach and other digestive organs through the connecting nerves of the service expected of them, thus enabling them to make the necessary preparation and to be in readiness. When food is taken in the liquid form, so that it is swallowed readily, or is rinsed down with water or other liquid, there is no opportunity for the exercise of this important function.

For our own well-being it is necessary that we should learn to recognize in the sense of taste not simply a means of pleasure, a gustatory instrument upon which, by the aid

of the cook, the caterer, and our own ingenuity, we may play an almost indefinite variety of tunes, so to speak, through the combinations, alterations, and successions of flavors of various sorts, disregarding so far as possible the nutritive needs of the body and the capacity or condition of the stomach, but as a divinely appointed guide to our appetites.

With many, the question raised when palatable things are presented is not, "Am I in need of food?" or, "Is this food adapted to my wants?" but, "Will it taste good? Has it a piquant or agreeable flavor?"

Degradation of the Sense of Taste.

The amount of money expended in the mere gratification of the palate is immensely greater than that devoted to any other sort of sense indulgence. Roman emperors expended enormous fortunes in a single feast. On visiting the ruins of Rome some years ago, the author was led into a spacious apartment which was once the dining room of Nero, the tyrant, the murderer, the libertine, the gormand, certainly one of the most vicious men of whom history gives us account. A small room adjacent, easy of access, was pointed out as the place where this unspeakably unclean monarch retired from the banquet room at intervals to empty his stomach, so that he might continue his swinish excesses. Thousands of persons to-day do little better. Though suffering daily from the effects of their dietetic abuses, they refuse to turn away from their evil habits, and continue to swallow pastries, rich gravies, sauces, ices, confectionery, pickles, cheese, and other dietetic abominations; they return, as the Scripture says, "like a dog to his vomit," though

knowing well enough by experience the certain consequences of indulgence.

The sense of taste, when properly used, is one of the body's most important safeguards. An unperverted palate is a wise and ever-wakeful sentinel, which says promptly to the eater, "Enough," when he has swallowed a sufficient amount of nutrient material to meet the present requirements of his body. On the other hand, the perverted and abused palate is one of the most certain and expeditious agents for defiling the body temple, destroying its beauty, externally as well as internally, and opening the door to a whole legion of evil spirits, through which the temple may become the hold of every "unclean and hateful bird." From the Thanksgiving feast to the bacchanalian revel, the saloon, the dance hall, the gambling hell, the brothel, is a short road with few turns. The palate was given man, not as an instrument of pleasure, but as a guide whereby he might select in proper quantities food substances of the quality suited to his needs. The debasement of this function to the ends of pleasure is the beginning of a prostitution of the body which ends only in abandonment to the grossest forms of self-indulgence, and ends in premature exhaustion of the vital resources, early decay of the body's forces, and ignominious death; for no death can be considered honorable which is the direct consequence of one's own acts, or suicide. Said an eminent French writer, "Man does not die, he kills himself."

Perverted Tastes.

Job asked the question, "Is there iniquity in my tongue? cannot my taste discern perverse things?" Job 6:30. While perhaps it is hardly fair to hold the tongue responsible, even

in the most flagrant departure from dietetic rectitude, it must be admitted that the tongue as an organ of taste is certainly made an instrument of the grossest and most inexcusable selfishness in holiday gormandizing and social feasting. How many may say with truth, "Can *my* taste discern perverse things?" Multitudes of men and women have departed so far away from the natural order, and have so long educated their palates in vicious ways, that the sense of taste is no longer a safe guide, but instead has come to be a source of temptation and a snare. Morbid cravings of the most destructive character demand gratification. The appetite for mustard, vinegar, highly spiced and greasy foods, pickles, cheese, even flesh meats, is altogether unnatural; and as the result of vicious training and perversion the palate which has thus been mistrained may actually refuse to recognize as good and satisfying the very best and most wholesomely prepared natural foods, and will turn away from bread to choose a stone or something equally indigestible.

It is doubtless true that the present is pre-eminently an age of gormandizing. There never has been a time in the history of the world when so much time and attention and money were given to the gratification of appetite by the masses. While there are a few who are seeking to know the divine order in diet and in every habit of life, the multitude are saying to themselves, "Let us eat, drink, and be merry," quite forgetting the sickness, suffering, and death which the morrow is sure to bring. "Whose end is destruction, whose god is their belly, and whose glory is their shame." Phil. 3:19. In these pointed words the apostle Paul draws a quick and graphic picture of a man given to the indulgence of appetite. It must have been the same sort of a man of whom Solomon spoke when he wrote, "All the

labor of a man is for his mouth" (Eccl. 6:7); and to whom the prophet Isaiah referred, "Yea, they are greedy dogs [margin, "strong of appetite"], which can never have enough." The end of such a man, as the apostle Paul truly says, "is destruction." Physical destruction surely comes sooner or later to every man who disregards those natural laws which govern the appetite, and which if followed would lead him to take into his stomach only such foods as are in the highest degree fit to sustain the noblest work of God, and in such quantity as is necessary to meet his daily requirements.

The Skin and the Sense of Touch.

The sense of touch, with its modifications, the sense of pressure and temperature located in the skin, and the associated sense of weight located in the muscles, are other channels through which we receive an immense amount of information concerning the world about us. The constant play of external stimulating influences upon the skin is one of the most important means by which the wheels of life are kept in incessant activity. The marvelous influence of light upon the skin, and through it upon the nervous system and other organs, has already been considered, as also the influence of temperature acting through the hot and cold nerves. Electricity perhaps also plays its part as a physiological stimulant.

All these influences combined, and perhaps others with which we are unacquainted, send in upon the brain, the spinal cord, and the sympathetic nerve centers a constant storm of impulses that are reflected to every organ and tissue, exciting activity, movement, secretion, blood circulation, every form of bodily activity. The skin exercise which results from the daily cold bath is a training of the brain

and nerves as well as of the skin and its vessels. The contact of cold water with the skin influences every bodily activity. The impression made, sends a vital thrill from the surface to the center, reaching every nook and corner of the vital domain, stirring every cell and fiber, awakening every dormant energy. In the reaction which follows a cold application, the individual is lifted to a higher plane of life, his vitality is at high tide; the whole body is roused and energized.

The plant that grows out of doors has a thick bark, strong roots, hairy leaves, and is tough and strong. It can survive drought, dry winds, and hot suns to a wonderful degree, while a plant of the same species raised indoors placed under the same adverse conditions, succumbs at once. This is due to the hardening which comes from out-of-door life. Every cell, every fiber of the out-of-door shrub has a higher grade of vitality, more resistance, more life, than the house plant. Precisely the same is true of human beings. Those who by out-of-door life expose their skins to the health-imparting influences of sunlight and cold air, are robust and hardy like the out-of-door plant, and for the same reason; while those who live indoors show by their pallid countenances and general lack of physical vigor the deteriorating influence of an indoor or sedentary life. It is impossible for any human being to live an indoor life without suffering deterioration, shortening of life, impairment of physical and mental powers, and with the rest a tendency to moral deterioration as well.

The skin may be aptly compared to a harp with a million strings, upon which the sunlight and all the subtle influences of the world about us are constantly playing harmonies that excite from every recess and chamber of the body sympa-

thetic responses, and help to make of life a grand and noble symphony, a tuneful song, sending out into the world about sweet notes of thought and act, of kindly words and helpful deeds. Let us not forget that the sunlight is God's smile of benediction; that the sunshine is Heaven's light and life and glory, the true Shekinah, the real presence with which the temple needs most to be filled; that the cooling breeze is the breath of heaven, a veritable messenger of life, carrying healing on its wings. Do not let one day pass, except from dire necessity, in which these mighty life-saving agencies shall not have an opportunity for an hour or two at least to do their work of cleansing, healing, energizing, and beautifying.

How We Remember.

One of the most remarkable of all the mental processes is memory. How are sight pictures and sound pictures and other impressions stored in the mind, and how are we able to recall them? Here again we are in the presence of a wonderful miracle, and at best we can only seek to make clear the fact by illustration and comparison. There are certain bodies possessed of a property known as phosphorescence. After having been exposed to daylight for a time, these bodies give off light in the dark. They store up certain portions of the sunbeam, and give them off again. This is a sort of a physical memory. These phosphorescent bodies simply continue in the dark that which they do in the sunlight.

In some way the impressions made through the eye, ear, and other senses induce such actions and changes in the nerve cells which are connected with these organs that under the right sort of stimulus the same action may be reproduced, and brought within the range of consciousness. This

reproduction of past impressions is secured through the connection of that portion of the brain which is the seat of consciousness with other portions in which impressions are stored by means of the delicate nerve branches previously described. The numerous connections of these nerve fibers bring them in direct or indirect association with all the different parts of the brain. In trying to remember, one often is conscious of an effort, and the brain may be very much wearied in a long-continued effort to recall impressions which have been partially effaced. The mental effort consists in energizing the fibers so as to make them project forward their delicate endings, thus making numerous contacts, perhaps millions, with different cells, until by and by the particular cell or group of cells in which the desired word or other impression was made is recognized. When one is weary, it is often difficult, sometimes impossible, to recall names or data of various sorts which may be entirely familiar. This is because of the impossibility of energizing the nerve cells sufficiently to make the desired contacts. Anything which benumbs the nerves, as alcohol, tobacco, tea, coffee, opium, may have the effect to benumb the nervous sensibility and lessen nervous energy, and thus operate deleteriously upon memory. Memory, however, is perhaps most seriously injured by loss of sleep, whereby brain energy becomes exhausted. Sometimes the memory may be for the time being almost entirely effaced by long-continued loss of sleep.

Depreciation of memory in old age is one of the first indications of failing mental power. It is interesting to note, however, that the memory of events which happened in early life are often remembered, while others of recent occurrence quickly pass from the mind.

How to Have a Good Memory.

The essentials of a good memory are, first, good attention. The permanence of the impression made will depend upon its intensity. The longer the impression continues, the deeper the impression made. The more active the mind in relation to the impression made, and the larger the number of nerve cells involved in it, the longer it is likely to be retained. It is necessary to dwell long and repeatedly upon those things which it is desired to permanently fix in the memory.

When one seeks to memorize a passage of Scripture or the words of any author, he should begin by making a careful analysis of the thought conveyed and of the relation to each other of the various subdivisions of the subject. Suppose, for example, that one desires to memorize the 116th psalm. We first read the psalm through. Then we will begin a careful analysis of the thought of each sentence and each verse. We will consider the first two verses by way of illustration: "I love the Lord, because he hath heard my voice and my supplications. Because he hath inclined his ear unto me, therefore will I call upon him as long as I live." What is David's declaration?—"I love the Lord." Why did he love the Lord?—"Because he hath heard my voice and my supplications." We now have clearly before the mind the whole thought of the first verse. We know that David loved the Lord, and the reason why, and we will not be likely to forget it. The whole verse should be repeated carefully each time with the analysis. Now let us consider the second verse in the same way. We find the language of this verse is inverted. The principal thought comes last, the secondary first. David declares that he will call upon the Lord as long as he lives, and gives his reason, "Because

he hath inclined his ear unto me, therefore will I call upon him as long as I live." Repeating once or twice, we return to the beginning, and recite both verses, either mentally or orally, and thus continue verse by verse until the whole chapter is learned. By this careful analysis of the subject-matter to be committed to memory, a strong impression is made upon the mind, a large number of nerve cells are interested in the preservation of the impression, and thus its permanence is secured, and the way is prepared for recalling it readily.

The principle of association is of very great value as an aid to memory. New facts and impressions should be associated with old ones that have long been familiar, and cannot be forgotten. Various memory systems are based on this principle, the consideration of which, however, would scarcely be appropriate for this work.

Clearness of thought and retentiveness of memory are qualities which belong to a healthy brain unclouded by disease or by the consequences of evil habits; overeating, especially of flesh foods, and indigestion resulting from any cause, are particularly likely to weaken the memory, and produce a state of mental confusion, lack of power to concentrate the mind, indecision. Many persons suffering from these conditions imagine that the brain is becoming diseased, whereas the whole fault is in the stomach, or rather is due to evils in diet which should be corrected.

Recent Interesting Discoveries about Nerve Cells.

The discovery of the fact that the nerve cells are capable of extending or retracting their branches, and thus making or breaking the contact with other cells, affords at least a partial explanation for many interesting mental processes.

For example, sleep is the result of the retraction of the nerve branches whereby the communication between the seat of consciousness and various other parts of the brain is interrupted through the breaking of contact of the nerve cells. Opium, cocain, alcohol, chloroform, ether, and other narcotic poisons have been shown to have the power to cause the nerve branches to contract. This explains the effect of these substances in producing insensibility to pain, unconsciousness, and sleep.

The effort to recall a fact or a circumstance is simply an act of the will stimulating the nerve cells, and causing them to stretch out their branches in various directions. The moment the right contact is made, the desired fact or picture flashes before the mind. Delirium and insanity are simply the result of abnormal contacts which are caused by some irritating substance in the blood, or a disease process in the blood.

Influence of Alcohol and Tobacco upon Nerve Cells.

These facts make very clear the influence of unwholesome diet and various poisonous drugs, not only upon the brain and mind, but upon the character. Alcohol renders a man temporarily insane by paralyzing certain of the nerve cells, so that the brain is unable to make those contacts necessary for the formation of correct judgment. Irregular and unnatural combinations are formed often with the most disastrous results. A man who naturally is peaceable, under the influence of liquor becomes violent, destructive, a veritable beast in ferocity. In the disease known as delirium tremens the nerve contacts become curiously mixed up, so that the sufferer sees snakes, reptiles, and all sorts of monsters and strange shapes before him. Such a patient once mentioned to the

author that he saw a sheep with a huge proboscis like an elephant, and chickens with enormous heads and jaws like crocodiles, with their mouths wide open, rushing at him. The terror which he experienced was a good lesson for him, and led him to repentance and reform.

These facts forcibly impress upon one the evil effects of alcohol, tobacco, and other poisons which paralyze the nerve cells, destroying those cell groupings which are necessary for the maintenance of health of mind and body. It is evident also that the brain and nerves may be subjected to grave disturbances through the action of poisons which may be formed in the stomach and intestines as the result of indigestion and the putrefaction of food stuffs, which readily undergo these changes when not promptly absorbed. Here is an explanation of mental confusion and dullness so commonly met with in dyspeptics, drowsiness, irritability, depression, and various other distressing symptoms from which so many suffer. Mustard, pepper, pepper-sauce, and other irritants also act in a destructive way upon nerve cells, as well as upon other parts of the living organism.

Another class of poisons which are to a high degree paralyzing and irritating in effect are uric acid, oxalic acid, and other poisons which are naturally generated in the body when right conditions for health are not maintained. These poisons are especially liable to be formed in persons who eat excessively, and especially flesh eaters, those who make free use of sugar, candies, and other sweets, and those who do not take a sufficient amount of exercise. Sedentary persons, especially those who eat heartily, sooner or later become rheumatic through the accumulation of those tissue poisons which represent incompletely oxidized or half-burned food

substances, the cinders, the extremely poisonous character of which has been previously pointed out.

Sleep.

During perfectly sound sleep the brain is wholly inactive. The blood recedes to other parts of the body, the spaces about the nerve cells are filled with lymph, and the parts worn by use undergo repair. During the activity of wakefulness, there is little opportunity for repair of tissue. This work is done almost wholly during sleep. During unsound sleep the brain is active in a partial and disordered way, so that confused and indistinct pictures are brought before the consciousness. The result is dreaming.

Dreams often afford important indications respecting the condition of the brain. When one constantly dreams at night of the work which he has been doing, it is an indication that those portions of the brain employed in the daily occupations are overwrought and congested, so that they are not being properly rested and restored at night, and are in a way to become seriously diseased. A person suffering in this way should immediately suspend his ordinary pursuits by a vacation, and should seek diversion of mind in a change of occupation, and should dismiss from his mind so far as possible the subject of his dreams.

Dreams are also to a certain extent an index to the character. One dreams most of those things of which he thinks most. If one's dreams are of an abhorrent or impure character, the remedy must be first of all sought in proper discipline of the mind during the waking hours. Frightful dreams of physical struggle, and dreams of combat, are in the highest degree exhausting, and demand the application of reme-

dies for securing better sleep. Such dreams are commonly due to disease, especially neurasthenia.

Insomnia.

This very common condition is most often due to six o'clock dinners or eating in the evening. To secure sound sleep, no food should be taken after 4:00 P. M., or at least nothing more than a little ripe or stewed fruit, without cream, and with as little sugar as possible, better with none. Oranges or some other juicy fruit are preferable for an evening's lunch. Avoid bread and butter or milk, and similar articles which digest slowly. Fruit juices and completely predigested food substances may be added in moderation.

Tea and coffee also produce sleeplessness. Sedentary habits conduce to sleeplessness by promoting the accumulation of uric acid, which is a nerve excitant, and gives rise to restlessness and to disturbing dreams.

Said the wise man, "The sleep of the laboring man is sweet." Eccl. 5:12. Gentle fatigue produced by exercise out of doors is wonderfully effective as a means of producing sleep. A prolonged bath, fifteen to forty minutes, or even longer if necessary, at a temperature of 92° to 95° F., taken just before retiring, is an excellent remedy for sleeplessness. The moist abdominal bandage, consisting of a towel wrung quite dry out of cold water and wound around the body, covered snugly with mackintosh and then with flannel in sufficient quantity to keep it warm, is an exceedingly helpful measure in producing sleep in cases in which sleeplessness is due to excess of blood in the brain. Care must be taken to keep the feet warm. If necessary, a hot bag may be applied to the feet or a moist pack to each leg. If the head is hot, a cool compress may be applied.

Nerve Poisons.

Alcohol, tobacco, tea, coffee, opiates, and a host of drugs taken in the form of nostrums and patent medicines and much-vaunted drugs, are poisons. Some obtund nervous sensibility, giving ease from pain, weakness, worry, and other discomforts, but only by deceiving, by covering up the cause instead of removing it. So-called tonic drugs are, like narcotics, deceptive in their effects, producing an impression of strength and vigor which really does not exist. The artificial felicity induced by the use of nerve-deceiving drugs is so great that the habit is readily formed. Many thousands of persons go down to untimely graves annually through the influence of alcohol, opium, tobacco, cocaine, and other equally destructive drugs. Drug habits of all sorts may be overcome by judicious management if the individual himself desires to be set free. A simple dietary, excluding flesh foods, warm baths, rest, and good nursing, will greatly aid in relieving the nervousness and other distress which immediately follow the removal of a narcotic drug, and the daily cold bath and the continuance of a simple natural dietary will aid greatly in building up the nervous system and fortifying it against a relapse.

Neurasthenia, or nervous exhaustion, which is an exceedingly common malady, deserves at least brief attention. The brain is one of the most enduring organs of the body. It receives one fifth of all the blood supply, and cannot easily overwork as long as other conditions are normal. Wholesome food and a good digestion, with plenty of out-of-door exercise and a proper amount of sleep, will so fortify the brain as to enable it to do each day as much work as it can be made to accomplish. Loss of sleep breaks down the

energy of the brain and nerves very rapidly, as proper opportunity is not given for the repair of the damage done by work. Continuous use of a single faculty or a circumscribed portion of the brain in some particular pursuit more often leads to nervous breakdown than does much more arduous work of a more general character. Variety in mental labor is one of the best means of resting the brain. Worry tears down the mental forces by preventing reparative and nutritive changes. Worry is nearly always carried into the sleep in dreams, preventing sound and refreshing sleep.

A Common Cause of Nervous Exhaustion.

The most common of all causes of nervous exhaustion is autointoxication, or saturation of the body with its own poisons. These poisons lessen the natural energies of the brain, rendering the brain cells less acute and less capable of mental effort. Autointoxication is most commonly produced by meat eating, though it may be the result of excessive eating of any sort, especially in sedentary persons who do not exercise sufficiently to burn up the food material which they take in. It should be remembered that a sedentary person, no matter how hard he works his brain, consumes in work only two fifths as much food as does the man who actively engages in muscular pursuits. If he eats as much, the three-fifths excess which he takes into his system is rapidly converted into waste, clogging material, cinders, which poison and hamper every tissue, exercising their pernicious influence upon the brain and nerves, particularly as shown in depression of mind, irritability of temper, confusion of thought, inability to concentrate the mind, indecision, despondency, and suspicion.

All these conditions may be combined in a single case

of neurasthenia. The most effective remedy is to be found in a simple dietary, excluding flesh foods of all sorts. It is best to take dry food, and to masticate it very thoroughly. Cereals and fruits, with a moderate allowance of nuts, are the choicest food stuffs for a case of this sort. The daily cold bath taken every morning on rising, the warm bath on retiring, are measures of the highest value. An out-of-door life, with moderate exercise sufficient to maintain activity of the skin and lungs, is an admirable means of building up a depreciated nervous system, purifying the blood, stimulating to action the chest and heart, thus cleansing the tissues and urging to increased activity every vital function.

The influence of dress upon the nervous system, especially in the case of women, is a question which cannot be ignored. Compression of the waist, either by corsets, tight bands, or heavy skirts, injures the nervous system, not only by deterioration of health and interference with breathing, but by forcing down the stomach, bowels, kidneys, and other important vital organs, and thus imposing a damaging strain upon the delicate nerve fibers which are supplied to these organs. As the result of this abnormal strain, numerous reflex disturbances arise, among which may be mentioned pain in the back, between the shoulders, in the back of the neck, the top of the head, the eyes, depression of spirits, pain in the legs, numbness, and general nervous exhaustion.

How to Have a Clear Head.

The man who desires to have a clear head, a brain keenly alive to the subtle influences of the universe about him, alert to respond to every call made upon it by the bodily organs under its supervision, ready to receive impressions from the infinite source of universal thought, and capable

of thinking the high thoughts of God after him, must live simply, abstemiously, naturally, and must avoid every harmful and inferior food. He will select the choicest food stuffs. These will consist of fruits, nuts, legumes, and dextrinized grains,— that is, well-toasted grain preparations, toasted bread, toasted wheat flakes, etc. He will eat sparingly, never to repletion. He will exercise out of doors at least two or three hours daily, living as much of the time as possible in the open air. He will sleep eight hours at night. He will take a vigorous cold bath every morning on rising, and, at least two or three times a week, will take a warm cleansing bath just before going to bed at night. He will conserve for useful work every energy of mind and body. He will endeavor to live righteously in the largest sense of the word.

The Relation of Diet to Mind and Character.

An old German proverb runs, "As a man eateth, so is he." This ancient saying, though expressing a profound biological fact, may possibly be a parody upon a proverb of still older date, "As a man thinketh, so is he." Accepting the self-evident truth of both of these wise sayings, we find ourselves in possession of a new proverb, the logical outcome of these two, "As a man eateth, so he thinketh," and this is the text of this chapter. The older orthodoxy regarded man as in a state of total depravity, prone to evil, and the soul the seat of every vice, the source of all sin. The theological teachers who were responsible for this doctrine evidently overlooked the fact that the wisest of Christian philosophers, Saint Paul, clearly enunciates the opposite thought. Said Paul, " Howbeit that was not first which is spiritual, but that which is natural; afterward, that which

was spiritual." 1 Cor. 15:46. Paul distinctly puts the body first, not in importance, but in time. Physiology clearly teaches the precedence of the body in the development of the human being. The palpitating, growing body exists long before there is the first beginning of mental or moral activity. The new-born child is simply a breathing, eating, sleeping bundle of living cells, but incapable of intelligent action of any sort. Its movements are altogether automatic, governed by an intelligence higher than its own.

Mind and character are the products of an after development in which the body plays a fundamental part. Men, long ago, learned that muscles are made out of food, and that there is a most intimate relation between food and strength, between eating and capacity for muscular work. From the times of the ancient Greeks, when men were trained for public games and other contests, down to the present day, men in training for a special effort of any sort requiring an unusual exhibition of muscular power, have been required to submit to a rigorous restriction of their dietary to such foods as experience has shown to be best adapted to support the highest degree of muscular activity and endurance. The most ignorant and unobservant peasant recognizes the intimate relation between the quality and quantity of the food supplied to his horse or his ox and the work which the animal can do.

It is strange indeed that so little attention has been given to eating in its relation to mental work. The majority of men give little or no attention to their eating except to secure a sufficient amount of food possessing the right sort of palate-tickling flavors to satisfy hunger and taste, without considering what quality or quantity of food stuffs will best support the muscle and nerve activities in which they

may be engaged. A starved brain must be a weak brain, and incapable of the highest degree of activity. Nevertheless, in a starving man the brain remains active when the muscles have lost their power, by reason of the fact that, recognizing the paramount importance of cerebral activity, nature robs the rest of the body to feed the brain. The brain of the overfed man, on the other hand, may be crippled through the clogging influence of the imperfectly oxidized waste substances which paralyze the brain cells and cloud the intellect.

The body is like a furnace. The food substances taken into it are burned, or oxidized, in the body just as is coal in a stove or a furnace. The products of combustion escape from the furnace through a smoke pipe or chimney. So the products of vital combustion or oxidation escape from the body through the lungs, skin, and other excretory organs. When too large an amount of food is taken, the situation of the body is the same as that of a stove or furnace which is overcrowded with fuel; the combustion being incomplete, volumes of smoke are produced which choke the fire, and may extinguish it. An excess of food fills the body with organic smoke or imperfectly oxidized waste substances, of which uric acid is the best known representative, and of which rheumatism, neurasthenia, or nervous prostration, neuralgia, nervous headache, bilious attacks, apoplexy, paralysis, and various other disorders, are the natural results.

The body is a factory of poisons. If these poisons, which are constantly being produced in large quantities in the body, are imperfectly removed, or are produced in too great quantity, as the result of overfeeding, the fluids which surround the brain cells and all the living tissues are contaminated with poisonous substances, which asphyxiate and

paralyze the cells, and so interfere with their activity. This fact explains, in part at least, the stupidity which is a common after-dinner experience with many persons, and with some people who are habitually gross eaters, is a confirmed, ever-present state.

This is as true of the brain as of every other organ. A brain which receives impoverished blood is hampered in its activities. A brain surcharged with blood is, on the other hand, overexcited. The result may be sleeplessness and irritability, even frenzy, mania, or insanity. If the blood is charged with irritating substances, the organs through which it circulates will be naturally exposed to abnormal irritation, excitation, and disturbance of function. A brain receiving too large a supply of blood must suffer first and most in this regard. Whatever is taken into the stomach and absorbed, enters the blood, and circulates through the body. The odor of nicotine which hangs upon the breath of the smoker, the alcoholic odors which emanate from the body of the inebriate for many hours after he has ceased drinking, are evidences of this.

Nerve Poisoning through Indigestion.

Bouchard has shown, by incontrovertible evidence, that the changes which often take place in the stomach and intestines when in a state of indigestion resulting in fermentation and putrefaction, give rise to poisonous substances which, when absorbed into the body, may produce effects entirely similar to those produced by strychnia, opium, alcohol, and other well-known drugs. When food is retained in the stomach beyond the normal time, either because of its indigestibility, the taking of too large a quantity of it, or a crippled state of the stomach, these changes are certain to take

place. This fact explains a very large share of the myriad symptoms which afflict the chronic dyspeptic. The giddiness, the tingling sensations, the confusion of thought, and even partial insensibility, which are not infrequently observed a few hours after meals in chronic dyspeptics, are due to this cause. Here is the explanation of the irascibility, the despondency, the pessimism, the indecision, and various other forms of mental perversity, and even moral depravity, which are not infrequently associated with certain forms of gastro-intestinal disturbances.

The total depravity which we often hear talked about, is, half the time at least, nothing more nor less than total indigestion.

For parents who find their children still ungovernable, notwithstanding the frequent use of the rod, we recommend the advice of a wise writer, that "cow's milk is a much better means of curing a boy's waywardness than cow's hide." Many parents who give their children an abundance of wise counsel and religious training send their boys to the saloon and the brothel by the influence of morbid and inflamed appetites, engendered by the irritating and passion-stimulating foods with which they feed them at the dinner table.

The Relation of Diet to Intemperance.

The relation of food to intemperance is well worthy of most careful and earnest consideration. It is perhaps not going too far to say that the cooks make more drunkards than the saloon keepers. Bad cookery leads to indigestion, and frequently the indigestion leads to the taking of bitters of some sort to correct it, a remedy which is worse than the disease. The victim goes first to a doctor, who prescribes

some variety of tonic bitters, ready prepared or otherwise, and in a little time the man gets to buying bitters for himself. A man was found drunk on the streets some years ago with a bottle which had held "—— Bitters" in his pocket. Certain bitters contain sixty per cent of alcohol, more than the best Scotch whisky. Saloons keep patent medicines and "bitters" of various sorts on their shelves, for many of their customers prefer them to other drinks.

The more serious and deeper reason why stimulating foods lead to intemperance, is in the perversion of the use of the sense of taste. Certain senses are given us to add to our pleasure, as well as for the practical, almost indispensable, use they are to us. For instance, the sense of sight is not only useful, but enables us to drink in beauty, if among beautiful surroundings, without doing us any harm. The same is true of music and other harmonies which may come to us through the sense of hearing. But the sense of taste was given to us to distinguish between wholesome and unwholesome foods, and cannot be used for merely sensuous gratification without debasing and making of it a gross thing. An education which demands the enjoyment of pleasure through the sense of taste, is wholly artificial; it is coming down to the animal plane, or below it, rather, for the instincts of the brute creation teach it to eat to live.

The effects of gratifying the sense of taste differ materially from those of gratifying the higher senses of sight and hearing. What we see is gone; nothing remains but the memory. And the same is true of the sweetest sounds which may reach us through the ears. But what we taste is taken into the stomach and what has thus given us a brief pleasure through the gratification of the palate, requires the incessant

labor of millions of glands and other structures connected with the alimentary canal for many hours before it is disposed of.

The proper regulation of the dietary may be certainly made one of the greatest of all helps to purity. The person whose nerves are habitually highly stimulated and irritated, whose blood is excited and made feverish by the daily use of condiments, pungent sauces, and tea and coffee, may not possess the needed moral strength to resist successfully the temptations to impurity which may assail him and to which his unwholesome diet has rendered him especially susceptible. The descent from virtue to vice is a gradual one, not a sudden transition from one state to the other. When the animal instincts are excited by the habitual use of stimulating foods, the resisting power of the will is gradually undermined; little by little, the conscience is silenced, and the lower instincts gain the ascendency.

The influence of flesh foods in stimulating the animal instincts is too well understood and recognized to require enforcement by argument. The fruit-eating savage, although unrestricted by either civil or moral laws, is less impure in conduct than are multitudes of the meat-eating dwellers in civilized lands.

The feverish blood, the excitability of nerves and nerve centers, the contamination of the body with waste and excrementitious matters which result from the use of flesh food, are antagonistic to purity. Parents who encourage their children in the use of flesh foods, or who do not exclude such articles from the dietary of their children, are themselves to a considerable degree responsible for the departures from purity which are so often charged to the influence of companions, or to pure wantonness. A writer has well

said: "Keep yourself from opportunities, and God will keep you from sin." A diet which tends to excessive irritability of the brain and nerves, creates incitements for impurity in children from which the most careful moral teaching may not save them. This principle applies to older persons as well as to children.

Relation of Gluttony and Impurity.

Purity of the mind is a condition quite incompatible with gluttonous habits of eating. The pages of history are crowded with facts which clearly show that the successive degeneracy of each of the nations which ruled the world, began with luxuriousness in diet. Dante, in his picture of the infernal region, puts the glutton and the sensualist in the same circle. Plato insisted that all books which pictured gratification in eating and drinking should be banished.

The sacred Scriptures inculcate the same principle. Simplicity in habits of life and purity of character are everywhere associated. While leading the simple life of a shepherd lad, David developed those elements of character which fitted him to become the greatest among all the kings of Israel. John the Baptist found in the natural products of the wilderness a bill of fare, the simplicity of which comported perfectly with the purity of his divine mission. And by his forty days' fast in the wilderness, our Lord taught us a most important lesson respecting the necessity for bringing the appetite under full subjection.

Self-control is the keynote to purity of conduct. Said Paul, "I keep my body under." He who will govern his appetite in accordance with nature's laws, will thereby gain a powerful advantage in the control of other animal instincts.

Simplicity in habits of eating, and the avoidance of all

stimulating foods, are, with the exception of religion, the most powerful of all aids to purity of life, and in addition are most potent correctives of impure tendencies when they are once developed. Talmage says that "many a man is trying to do by prayer what can only be done by correct diet." Certain it is that earnest prayer and pure diet together accomplish what would be impossible, attempted by either agency alone.

The race deterioration, so evident at the present time, must be in no small part attributed to the neglect to properly study this question of diet. We cannot hope that racial decline will cease, or that extinction of the race shall be averted, unless we so awaken to the truth of the apostle Paul's declaration, "Ye are the temples of the Holy Ghost," that we shall write over our sanctuaries of worship and of learning, that noble motto which the ancients carved over the portals of their temples, *"Mens sana in corpore sano."* We must recognize as a solemn reality that religion includes the body, and that the laws which govern the healthful performance of the bodily functions are as much the laws of God as those of the decalogue. While man regards his body as a harp of pleasure to be played upon so long as its strings can be made to vibrate, so long will he continue to travel down the hill of physical decadence and degeneration in spite of quarantine laws and the most minute sanitary regulations. But when he recognizes his divine origin and obligations, and himself as the crowning masterpiece of creation, his body a precious thing, to be sacredly preserved, developed, expanded, and purified for service for humanity in this world, and a never-ending opportunity for development and joyous existence in the world to come, then only will

he begin to climb toward the heights from which he has fallen, where he may once more stand forth as the crowning glory of creation, the masterpiece of God, "the beauty of the world, the paragon of animals."

The Reasoning Faculty.

Although man possesses in the highest degree of all earthly living forms the faculty of reasoning, he does not always reason, and is by no means always reasonable. The faculty of reason is not peculiar to the human race. Reason seems to be the common possession of all animals that have brains. Wherever there is an eye, there is a brain behind, an intelligence looking out. It is such a common practice to deny this, and to ascribe to man alone the power of reasoning, maintaining that the animals are guided by instinct alone, it seems proper to introduce at this point a few illustrative facts which will show the contrary.

Animals show reason in a variety of ways. To reason is to draw conclusions, to connect a result with a cause. Cats and dogs learn to unlatch doors by watching their masters, to raise the lids of boxes, and to do many similar things. Horses and cows learn to unfasten fence gates. Monkeys have been taught to pick cotton and to do other useful work. Professor Darwin tells of an ape that was able to "rise and fall the scale." The exploits of shepherd dogs in herding cattle show a high degree of reason. The architectural feats of the beaver show reason to an extent almost beyond belief. The ability of animals to adapt themselves to emergencies, especially in the building of their nests and in coping with their enemies, often exhibits a considerable exercise of the reasoning faculty. A bird, for ex-

ample, sheltered her little ones in a nest during a shower by building over them a roof with a large leaf which she fastened in position with a straw hook.

The most insignificant insect gives unmistakable evidence of sagacity and of reason. There are ants which are agriculturists, cultivating the crop of seed-bearing grasses upon which they feed, nipping off the buds of other plants. Some ants provide in their underground homes chambers in which they raise fungi for food. In places subject to floods, certain species of ants actually build chimneys of mud which serve to admit air during a flood. Still other species go on regular marauding expeditions, traveling in regular battalions, and recognizing and obeying commanders. They assault and capture other species of ants, and reduce them to slavery, and like some men live as aristocrats while others toil for them. A certain species of ants carries on a regular dairy business, enslaving and regularly caring for an insect, the aphides, which produces honey. When the ant desires a sip of honey, he strokes the insect "cow" with his feelers, and presently a small drop of honey appears, upon which he regales himself, and passes on.

The wise man of old clearly recognized the reasoning faculty in lower animals when he said, "There be four things which are little upon the earth, but they are exceeding wise: the ants are a people not strong, yet they prepare their meat in the summer; the conies are but a feeble folk, yet they make their houses in the rocks; the locusts have no king, yet go they forth all of them by bands; the lizard taketh hold with her hands, and is in kings' palaces." Prov. 30:24-28 (R. V.)

How the Human Mind Differs from Mind in Lower Animals.

Man is distinguished from the lower members of the animal creation by the possession of the reasoning faculty to a higher degree than any other living creature, and special reasoning powers which creatures below him in the scale of existence do not possess. There are some particulars, however, in which the animal seems to show better sense, if not a superior reasoning faculty, than does man. This is particularly true as regards the animal's regard to the conditions which relate to its well-being. It may be truthfully said that man of all living creatures has departed farthest from the natural course of life marked out for him by the Creator. The gorilla, the ox, the horse, each adheres to the original bill of fare provided for it by its Creator. The gorilla may kill the hunter who invades his forest home, but he would never soil his teeth with the hunter's flesh, scrupulously adhering to his natural dietary of fruits and nuts. The cow feeds upon grass and coarse herbs, the horse upon grasses and grains. Those who believe that some animals were created with carnivorous instincts, point out the wolf and the lion which subsist upon flesh, while in the sea there are likewise found animals which are vegetable feeders, and others which live by prey. One would never expect to find a gorilla or a monkey living upon grass nor a horse upon flesh. These animals turned loose in the forest have no difficulty in selecting the foods which are adapted to their individual needs. They do not require teachers to instruct them what or how much they should eat or when they should drink. The natural sense of the horse guides him in all these matters and leads him rightly, but man has, so to

speak, lost his horse sense, and positively knows less about what is good for him healthwise than do "the beasts that perish," at least if one may judge from his conduct. Instead of eating the food designed for him by nature, he seizes upon all the forms of vegetable and animal foods upon which all created animals subsist, and includes them all in his bill of fare, forgetting that his one puny stomach cannot possibly be prepared to digest the bill of fare of the whole animal creation.

Human Instinct.

In every creature there are divine voices, commonly called instincts, which are ever saying, "This is the way; walk ye in it." Isa. 30:21. The "voice behind" is an inner voice, behind the consciousness, behind the will, speaking through the instincts to every living creature. It is God the Creator leading the beast or the man in the way in which he should go.

The instincts express themselves in a great variety of ways, and afford overwhelming evidence of the active and beneficent care of an all-wise being.

The instinct which leads a horse back to its home when its human rider may have wholly lost his way, is a wonderful illustration of this. The homing instinct of the pigeon affords still more striking evidence of the leading of an intelligence far superior to that ordinarily manifested by this humble creature. The instinct which leads migratory birds to start on the long journey from their summer breeding places to their winter homes, and which brings them back year after year to the same places after months of wandering, affords incontestable evidence of an intelligent leading which is infinitely above the ordinary intellectual operations of birds.

Does man possess anything corresponding to instinct?

There can be no question that he does. The desire for food, thirst, hunger for the woods, and delight in out-of-door life common to all normal human beings, the paternal instinct, the maternal instinct, the instinctive love of life, are all manifestations of instinct which should not be regarded as mere blind faculties, but should be looked upon as proofs of an active, alert, ever-present, and infinitely wise intelligence, pointing out the way of life, happiness, duty, and well-being.

Perhaps the most important of all instincts, and closely associated with them, is the moral instinct manifested through the conscience, prompting man to do right. This is the law of God written in the heart. Rom. 2:15; 2 Cor. 4:2; John 8:9. The conscience prompts to right conduct. It suggests the choice of right instead of wrong. It is the "true light which lighteth every man" (John 1:9), and to the leading of which David desired to surrender himself when he prayed, "O, send forth thy light and thy truth, and let them lead me." Ps. 43:3. That the conscience does not always lead wisely is due to the fact that it may be misinterpreted as the result of wrong education, and, like all other instincts, may be well-nigh smothered and even extinguished, in fact, seared as "with a hot iron." 1 Tim. 4:2.

The Law of Life.

Man alone possesses a conscience, he alone has moral faculties and moral responsibilities. It is the conscience which lays the foundation for religion, the sense of duty, and of moral obligation. A well-trained conscience will recognize that duty and obligation are not the result of arbitrary enactment, or of rules imposed upon man, or modes of conduct artificially or arbitrarily marked out for him, but rather the natural and necessary conditions of the divine order of life;

that they are the outgrowth of the nature of things, of his own nature, and of his relation to himself and to the world, to his fellow men and to God. Recognizing this fact, it is impossible to select a few of the conditions which belong to the divine order, and to say of them, "These are moral obligations which must be obeyed," and to place to one side all the rest, and say of them, "These are physical obligations and relations which it is well to obey, but which man is at liberty to disobey if he chooses."

There is but one law, and that is *the law of life.* It includes all possible relations of man to himself, to his fellows, to God, and to the world. Man's obligation to obey does not depend alone upon the fact that God has made him; that he is the creature, God the Creator, and that he must obey, because God is greater than he, and has given him all that he possesses. The obligation is far greater than this.

Man's obligation to God is the outgrowth of —

1. The fact that God created him in his image, to be his representative in the earth, to be his witness (Acts 1:8), to have dominion over the earth and everything in it (Gen. 1:26), to be godlike king of the world.

2. The fact that in order that he might be the true image of God, a true witness and a royal ruler of the world, God put himself into him, became his servant (Isa. 43:24), that he might be godlike.

3. That God is ever present in man, showing him through his instincts, both physically and morally the way in which he should go, so that he need never be in doubt as to what course of action he should pursue, what his conduct should be, telling him when to eat, how much to eat, and what to eat; what to drink and when to drink and how much to drink; how to breathe; warning him against physical dangers

through the sensations of smell, taste, touch, pain, and other senses; warning him against moral dangers by the conscience.

4. That He ever stands ready to give him the power and the wisdom necessary to enable him to walk in the way laid down by the law written in the heart.

5. That obedience to the divine order is essential to his own happiness and well being, the necessary condition of life, here and hereafter.

Paul declared that the heathen were morally responsible even though the gospel had never been preached to them, because the law was written in their hearts. The conscience told them when they did wrong. They knew instinctively the difference between right and wrong, just as they knew by another instinct the difference between hot and cold, between sweet and sour. Both are due to the presence in the man of a divine intelligence, ever drawing him to the way which leads to life.

The sum of all the obligations that are the outgrowth of man's relationships to his fellows and the presence of an indwelling mentor and an unfailing source of power, constitutes the great decalogue of life, man's rule of conduct in things physical, mental, and moral.

Man's obligation to do right is based upon the fact that he has a conscience by which he may know right and wrong, and an indwelling spirit which, if he so wills, will enable him to do right. A man without a conscience is a moral imbecile, and the most savage of beasts. In the fact that man has a conscience which prompts him to do right and to inquire after truth, lies the only possible hope of rescuing him from his condition of darkness and degradation, physical and moral.

If man had no natural instinct capable of guiding him in

relation to what he should eat and what he should drink, he would be in no way responsible for his conduct in these particulars. There would be no obligation to restrain himself from overeating, unless he had within him a divine voice telling him when he had taken enough. So it is with every physical and every moral obligation.

The voice of God speaks to man as distinctly in relation to his physical habits as in relation to his moral conduct. God requires implicit obedience in all things.

When God speaks, it is man's duty to obey, and God gives him the power with which to obey. Thirst is the voice of God speaking to man telling him to take water, to quench his thirst. Chickens hatched in an incubator learn to drink water as readily as those who have the example of the mother hen. They have a better teacher than the mother, even. No animal requires to be taught to drink water. In order to become a drunkard, man must learn to drink intoxicating liquors. Water is sweet and cooling to the taste; liquor is hot, burning, and disagreeable. Water refreshes and quenches thirst; liquor creates thirst. Water gives strength, vigor, energy, and life; liquor the opposite. The evil effects of liquor drinking are not punishments arbitrarily inflicted, but divine voices; not figuratively, but actually, speaking to man, warning him, appealing to him, beseeching him to desist from his evil course.

"The wages of sin is death." Rom. 6:13. This is a principle which is absolutely true in a physical as well as in a moral sense. We see it demonstrated every day in the dying multitudes about us. Without sin, there could be no death. Man dies to-day in consequence of his own sins as much as did Adam. "For all have sinned." Rom. 3:23.

The Ministry of Pain.

For one who has suffered much, it may be difficult to understand that there is anything good in pain. Nevertheless, pain rightfully regarded is one of the greatest possible blessings to erring mortals. Suppose the hand could be thrust into the fire without feeling pain; suppose no pain were produced by cutting or burning the tissues; what would be the natural consequences? — Certainly the result would be such neglect to care for the body as would soon lead to its disfigurement, crippling, or actual destruction.

The author was some years ago acquainted with a gentleman who had lost several fingers of his left hand. On being questioned respecting the cause of the injury, he explained that the nerves of feeling of his left arm were paralyzed by a severe wound of the arm received from a saw. Some years later, while working out of doors on a very cold day, feeling no inconvenience, he neglected to care for his hand, and on returning home found it to be so severely frozen that several fingers sloughed off.

Pain, then, is a divine voice leading us away from wrong, telling us of the right, and warning us of danger. "For God speaketh once, yea twice, yet man perceiveth it not. He is chastened also with pain upon his bed, and the multitude of his bones with strong pain: so that his life abhorreth bread, and his soul dainty meat. He looketh upon men, and if any say, I have sinned, and perverted that which was right, and it profited me not; he will deliver his soul from going into the pit, and his life shall see the light. Lo, all these things worketh God oftentimes with man, to bring back his soul from the pit, to be enlightened with the light of the living." Job. 33:14, 19, 20–30. This is indeed the common

experience with man. We choose evil rather than good because of our perverse tendencies, until we find that it "profiteth not." Then only are we willing to turn away from evil.

Pain a Natural Consequence, Not an Infliction.

While pain is not an arbitrary infliction, but is the natural consequence of wrongdoing, the basic principle of God's method of disciplining and dealing with man is expressed axiomatically by Paul, the Christian philosopher, in the words, "Whatsoever a man soweth, that shall he also reap." Gal. 6:7. The idea that God inflicts pain, or that pain is in any sense an arbitrary or retributive punishment, is a notion altogether foreign to a proper conception of God. The Creator, the Lawgiver, dwells in the temple; whatever the temple suffers, he must share. In this way the indwelling presence bears all our pains and sorrow, and takes upon himself all our punishments. This is true for every man. God is no respecter of persons.

But the experience of pain is profitable only to those who say of sin, "It profiteth me not," and who, tired of the wrong way, having learned by experience, have turned their face steadfastly toward the right; and as they have reaped a harvest of pain from the seed-sowing of sin, they now begin to sow seeds of life and peace in right doing, and will surely reap the harvest thereof. "For he that soweth to his flesh shall of the flesh reap corruption; but he that soweth to the Spirit shall of the Spirit reap life everlasting." Gal. 6:8. To sow to the flesh is the Bible mode of expressing the transgression of law, departure from the divine order of life. Whether in physical or moral conduct, the sowing to the Spirit is simply obedience to the voice of God speaking

to us through our instincts, through the inspired Word, through every source of truth which points out the way of life. Sowing to the flesh is a misuse of the appetites and energies which God has placed at our command. Sowing to the Spirit is the implicit following of the guidance of that inner voice, the Spirit of truth which created man, which dwells in him, and which is ever pleading with him, "This is the way, walk ye in it."

Whatever man suffers, then, is simply the reaping of a harvest from a seed sowing. The sowing may have taken place many years before; indeed, the seed sowing may have been done several generations back, for the iniquities of the fathers are visited "upon the children of the third and fourth generations of them that hate" God and righteousness. Ex. 20:5. "The fathers have eaten sour grapes, and the children's teeth are set on edge." Ex. 18:2. This is not an arbitrary principle, but the operation of the great law of heredity. The son of the drunkard or of the tobacco user, of the glutton, or the man who has wasted his energies in youth by riotous living, must reap the harvest which the father has planted, for the reason that the son and the father are really one being. The son's life is simply an extension of the father's life. A twig cut from a willow tree and planted in the ground becomes a new tree, but is simply an extension of the tree from which it was taken. So also the child is a bud from the parent stock, and bears the iniquities of his father just as he bears his likeness, and for the same reason. If the father's nerves have been wrecked by exhausting expenditures of vitality, the son will be nervous, feeble, possibly epileptic. If the father has been a drunkard, the son is likely to be insane or idiotic. Every human being bears a heavy burden of tendencies to sin and predisposition to

disease which are an inherited harvest from ancestral seed sowing. "Nature is a good bookkeeper."

The man who justifies himself in the violation of the laws of health because he does not see any immediate effects, declaring, perhaps, "It may hurt other people, but it does not hurt me," is like an old man who would justify himself in planting thorn bushes, crab apples, poisonous upas trees, and worthless wild figs, instead of good trees, because he did not expect to taste the fruit. He is planting a harvest for his children. That the children of the present generation are suffering to a terrible extent from the evil seed sowing of their parents and grandparents, is proved by the fact that the proportion of idiots, imbeciles, and epileptics to all the population has increased within the last fifty years more than three hundred per cent. Lunatics have increased at the same rate, and if the increase should continue at the same rate for two hundred and sixty-five years, the total population will at that time have become idiots, imbeciles, lunatics, or epileptics. There is no possible way of escape for evil-doers,—for those who hate righteousness and rebel against God. Destruction claims them.

Is There Then No Hope for the Transgressor?

"And showing mercy unto thousands of them that love me and keep my commandments." Ex. 20:6. "Keeping mercy for thousands, forgiving iniquity and transgression and sin." Ex. 34:7. "The soul that sinneth it shall surely die. But if a man be just, and do that which is lawful and right, . . . he shall surely live." Eze. 18:4, 5, 9. "But if the wicked will turn from all his sins that he hath committed, and keep all my statutes, and do that which is lawful and right, he shall surely live, he shall not die. Have I any

pleasure at all that the wicked should die? saith the Lord God: and not that he should return from his ways, and live?" Eze. 18:21, 23. "He looketh upon men, and if any say, I have sinned, and perverted that which was right, and it profiteth me not; he will deliver his soul from going into the pit, and his life shall see the light." Job 33:27, 28.

After several centuries' exposure to the debasing and degenerating influences of Egypt, the children of Israel were, under the leadership of Moses, given a schooling in obedience while wandering forty years in the wilderness, the assurance being held out to them that if they would recognize and obey the principles presented to them for their government, in their individual and social life, they should be delivered from the leprosy and plagues, and various other maladies which afflicted the Egyptians and the people who dwelt in the land to which they were going, and should be healed from the hereditary tendencies which they might have acquired from their environment.

This fact is made clear by the following text: "If thou wilt diligently hearken to the voice of the Lord thy God, and wilt do that which is right in his sight, and wilt give ear to his commandments, and keep all his statutes, I will put none of these diseases upon thee, which I have brought upon the Egyptians: for I am the Lord that healeth thee." Ex. 15:26; Deut. 28:15, 22. From the above it is seen that the Hebrews were to be healed even before they were sick. This brings prominently before us the important fact that the man who is smitten down by an acute disease does not become ill so suddenly as circumstances would appear to indicate. Although the appearance of the illness is sudden, his body has been undergoing for a long time a preparation for the disease which has come upon him. Through wrong habits of some sort,

the resistance of his body has been gradually lessened, until it is no longer able to cope with the assaults made upon it by germs, or the influence of other causes of disease, which in a perfectly healthy state are not capable of producing any disturbance. In other words, the man who is taken suddenly sick has been ill for a long time before. This is what is known as predisposition to disease. This predisposition may be acquired by wrong personal habits or by heredity. The Lord proposed to heal the Hebrews before they were sick; that is, to remove through their obedience predisposition to disease, thus making them capable of resisting the germs or other causes of disease with which they might come in contact.

This renewal of the body, this renovation of the constitution, this reconstruction of the temple which is promised to the man who obeys, who puts himself in harmony with God and his laws, is a veritable new creation. It is the replacement of a diseased, perverted, sinful soul and body by a soul and body which are sound morally and physically. The apostle refers to such a change when he speaks of putting off the old man and putting on the new: "That yet put off concerning the former conversation the old man, which is corrupt according to the deceitful lusts; and be renewed in the spirit of your mind; and that ye put on the new man, which after God is created in righteousness and true holiness." Eph. 4:22–24.

Here is the hope for the transgressor, no matter how unfortunate may have been the entailments of his birth. Although a terrible incubus of degenerating tendencies may have been inherited from his earthly parents, the great Father of all men, from whom all men are descended, "whose offspring we are" (Acts 17:29), has provided a way by which through repentance (change of mind) and obedience, we may

be re-created, restored, and lifted above the thraldom of disease and sin. That we do not see such deliverance realized, is due only to human stubbornness and ignorance. With absolute willingness to obey, and absolute knowledge of the way of life, the way is open to escape from all the consequences of disobedience; for the same God who said, "Obey and live," embodying in an absolute command a most glorious promise, said also, "He giveth power to the faint; and to them that have no might he increaseth strength." Isa. 40:29. "Let the wicked forsake his way, and the unrighteous man his thoughts: and let him return unto the Lord, and he will have mercy upon him; and to our God, for he will abundantly pardon." Isa. 55:7. "This is the covenant that I will make with the house of Israel after those days, saith the Lord; I will put my laws into their mind, and write them in their hearts: and I will be to them a God, and they shall be to me a people." Heb. 8:10. "I beseech you therefore, brethren, by the mercies of God, that ye present your bodies a living sacrifice, holy, acceptable unto God, which is your reasonable service." Rom. 12:1.

The man who has inherited a feeble constitution, by sowing the seeds of health may build up vigor and strength. The man born with a predisposition to consumption may so develop his lungs and his vital resistance as to be less susceptible to this disease than is the ordinary man. The law of seed sowing and harvest is a universal one in relation to all man's conduct in life. A degenerate plant may be improved by cultivation; so a weakened and diseased body may be healed by obedience.

The promise made by Jehovah to the children of Israel is held out to all mankind. "Now therefore hearken, O Israel, unto the statutes and unto the judgments, which I teach you,

for to do them, that ye may live." Deut. 4:1. "And the Lord will take away from thee all sickness, and will put none of the evil diseases of Egypt, which thou knowest, upon thee." Deut. 7:15. "If thou wilt diligently hearken to the voice of the Lord thy God, and wilt do that which is right in his sight, and wilt give ear to his commandments, and keep all his statutes, I will put none of these diseases upon thee, which I have brought upon the Egyptians: for I am the Lord that healeth thee." Ex. 15:26.

There is healing power in obedience, just as there is destruction in disobedience. When the evil doer ceases to sin, and enters upon a life of obedience, the curative forces within his body rebuild, and thus renew his tissues, healing them and obliterating the consequences of transgression. Moral as well as physical healing requires an actual change in the individual. The only hope for the sinner is in such a transformation of soul and body as shall make of him a new man, physically and morally. This transformation begins the moment the human will surrenders to become obedient to the divine will. There is no substitute for obedience. There is no power in ritualistic forms or ceremonies to heal the soul's maladies, neither is there potency in palliative remedies which merely mitigate symptoms to heal physical diseases. The only sure foundation to health is in obedience to the laws of God, which are not arbitrary commands, but principles growing out of natural relations, which cannot be changed because of their infinite nature. The foundation of all curative processes is simply but fully expressed in the words of the ancient prophet, "Cease to do evil, and learn to do well."

The Problem of Heredity.

"Like father, like son," is a common adage. The facts of heredity are well known. Children resemble their parents and sometimes their grandparents or other relatives. Very close likenesses may be sometimes traced through several generations. The influence of heredity is seen in races as well as in individuals, as in the Jewish race and various other nationalities. But while the phenomena of heredity are so familiar to all, who can explain the principle or the method by which individual characteristics are transmitted from one generation to another? How can it be possible that the microscopic speck of life which constitutes the earliest beginning of a human being can contain all the potentialities of a king or a philosopher? Using an illustration suggested by the late Oliver Wendell Holmes, every individual human being is simply "the summing up of a long column of figures reaching back to Adam." How is it possible that so great a sum can be contained in so small a speck? Practically cut loose from the parent stock, only absorbing nutriment from it, this minute speck grows, expands, develops, unfolds, until being born into the world, a helpless little bundle of tender flesh and bones, apparently little different from millions of other human buds, and yet in actual fact as widely distinct from any other living thing as when it shall have attained mature development!

How Are Individual Characteristics Transmitted?

Natural science gives no reply. No theory of heredity has been propounded which meets the requirements. But Christian philosophy finds the answer in the law of consistency or continuity. The divine mind is ever consistent in

all its processes. Wheat always produces wheat. Tobacco seed grows tobacco; thistle seed, thistles. "Do men gather grapes of thorns, or figs of thistles?" Matt. 7:16. A twig from an apple tree grafted into a thorn bush bears apples; a rosebud implanted upon an apple stem bears roses still; a willow twig cut off from the parent tree, and thrust into the ground, grows up a willow, and not an oak. And why? — Because infinite consistency will not permit of confusion. Laws are not arbitrary enactments, but simply God's habit of doing things. The rosebud grafted on the apple tree is still a part of the original stock, simply growing in a different place, but as much a part of it as before. The child is a bud, an extension of the parents, not of the parents' life only, but of their bodies, their personalities, their souls.

Adam, though as an individual dead, still lives in the race — the race is Adam. The whole human race is simply an extension of the first pair. For the child to be unlike his ancestors would be as inconsistent and unreasonable as for the leaves or fruit of a young tree to be unlike those of the parent stock; for the child is simply a branch, a developing bud. The same creative power which observes the law of consistency by building each branch and twig and leaf of each particular tree in absolutely consistent harmony with the conditions under which the individual tree and all its predecessors have grown, and are growing, stands by the unfolding human bud, and builds it up to manhood or womanhood in harmony with this same principle of consistency.

In no other way could the law of sowing and reaping be fulfilled. Parents sow; great grandchildren reap. When David said, "All my members were written in thy book," he was simply expressing a truth which applies to every

human being, a principle which concerns the whole race, and embodies this great law of the extension of life and individuality from one generation to another, which sees the true individual, which sees the real and the greater man, not in the individual man, but in the race. Heredity is God's method of bookkeeping. There are items of debit and credit, and a final reckoning day from which none can escape.

Personality.

Wherever there is manifested a plan, a design, a purposive movement, this fact alone is evidence of a personality behind the plan, a power behind the movement. If one should find in the center of a forest a house, whether constructed of logs or of marble, the fact to him would be evidence that some human being had been there before him, and had planned a building. A bird's nest, an ant heap, a spider's web, is equally evidence of a personality, of an intelligence which has planned and executed. Every animal possesses a personality. The power to will, to plan, is one of the essential distinctions between the animal and the vegetable. Personality is not confined to large animal forms. It is possessed as well by the most minute creatures. Those microscopic specks of life, the white corpuscles of the blood, move about in a manner which indicates purposive action. They change their form, they move from place to place, they engage in a great variety of activities which are in harmony with their mission in life. We see in the world about us millions of creatures exhibiting personality.

In man the power to will, to plan, to execute, to originate, to create, is manifested in a higher degree than in any other living creature. The lower animals do not invent nor impro-

vise except in the slowest and most painful manner. Several generations sometimes may be required to advance a single step in the way of improving the mode of building a nest, or a method of defense; but man conceives a new thing in one moment, and creates it in the next. The marvelous achievements of civilization in architecture, in the arts, in printing, in surgery, and in all the useful trades and professions, are evidence of man's creative power, of his wonderful personality.

The Infinite Personality.

All about us in the world and in the universe there are overwhelming evidences of a greater, all-pervading, all-controlling personality. The regular rotation of day and night and of the seasons, the movements of the planets and the distant stars, the phenomena of plant life, all speak to us in unmistakable tones of a great Designer, a personal being, working, not above nature, but in nature, of whom nature is the expression. Physicists tell us all about the transformations of energy, the change of force from one form to another, of the conversion of light into heat, of heat into electricity, of electricity into magnetism, of magnetism into mechanical work, as in the operation of the motors which run our electric cars; but ask the wisest physicist on earth whence comes the energy of the sun, the universal power of gravitation, or what is the original source of energy, and he will confess that these questions are beyond the limits of his science. He will admit that he can find no better explanation than that of the psalmist, who declared, "Power belongeth unto God."

That the power behind, in, or beneath all the operations of nature is not simply a blind, unintelligent force, is clearly

enough manifested by the evidences of intelligence displayed in every object and operation of the natural world. A skeptic, walking one day across the plains of Texas, picked up a little flower known as the Texas star. He counted its five petals, its five stamens, its five green sepals, and then asked himself the question, "How did it happen that this little flower should have exactly the same number of stamens, petals, and sepals?" Applying the doctrine of chance, multiplying together the three fives, he found that there was but one chance in one hundred and twenty-five that such a combination would occur. But right about his feet he found a hundred such stars, and each one with five stamens, five petals, and five sepals. The probability that chance should have produced a hundred such flowers was but one in twelve thousand five hundred; but as he cast his eye over the plain, he saw that here was not only one hundred, but hundreds and thousands of millions of such stars, and that every year for ages millions upon millions of these flowers had been produced, always the same. He recognized the overwhelming weight of the argument. That such a thing could come by chance was utterly beyond belief. The only consistent conclusion to which he could come was that the Texas star was the product of a designer, a personality, a power, capable of planning and executing on a scale beyond all human calculation. Then as he thought of the stars overhead, and the incalculable distances which separate them, the infinite number, the infinite space through which they are scattered, yet all bound together in one vast system by a force which every instant thrills and pulsates throughout the limitless bounds of infinite space, without an instant's loss of time, without overlooking the smallest grain of sand, the atom, so that orbs so far apart as to be

invisible still keep time; when he reflected upon this majestic manifestation of infinite power beneath his feet and spread out in the blue universe over his head, he was compelled to exclaim aloud, "There is indeed a God who knows all and does all."

The Intelligence Displayed in the Natural World.

It is exceedingly interesting to note the manifestations of mind in nature, even in inanimate things. Observe the nice balance between the weight of the air and that of the smoke, by which the poisonous gases are carried upward in a gentle rising cloud, while the pure air clings to earth where it is needed for the support of animal life. Note the remarkable arrangement by which, in the freezing up of rivers and lakes in the fall, enormous quantities of heat are given off by the water in the formation of the ice, thus modifying the temperature of the chilly air, and so graduating the change from summer to winter; and again in the melting of the ice in the spring, the same quantities of heat are absorbed from the air, thus favorably modifying the oncoming summer's heat, which otherwise might become too intense. The minutest details of nature exhibit these wonderful adaptations and intelligent provisions in which are manifested a common sense, an adjustment of means to ends, which are entirely akin to the same faculties manifested in the operations of the human mind.

In other words, man recognizes that the great mind of nature is in essence like his own, only vastly transcending it; that the infinite personality is like his own personality, a truth which was uttered by the apostle Paul, who declared that the divine man, Christ, is "the image of God,"— "The embodiment of the divine nature." (Twentieth Century ver-

sion) (2 Cor. 4:4; Heb. 1:3); and that we, the sons of Adam, who was also made in the image of God, may be "changed into the same image." 2 Cor. 3:18.

Man's Kinship with His Maker.

The more one learns of nature, the more deeply one looks into the secrets of God's creative work, the more clearly does one recognize the kinship which exists between the human mind and the infinite, between the higher and nobler manifestations of human thought and the divine thoughts which are expressed in the sunlight, the clouds, the flowers, the trees, the fields of waving grain, the fragrant meadows, the rushing torrent, the heaving ocean, the whole moving, speaking universe about us.

And again, we are reminded of the remarkable declaration of the apostle in his impressive address to the Athenians, that "we are the offspring of God." Acts 17:29. All men are sons of God, hence must be related to him. While the whole human race has wandered far away from uprightness and naturalness, so that man has lost his high estate and become perverted, deformed, debased, and full of iniquity, the fact still stands that he is a son of God; and the invitation is ever held out to him to recognize this sonship, and to avail himself of its privileges by accepting his Creator as his master and ruler, by placing his mind and all his intellectual powers, his emotions, and every faculty of his being which is under the control of his will, under absolute submission to the divine will; so that the same beneficent Intelligence which unerringly and unceasingly guides and guards his heart, his stomach, his liver, and other of his bodily organs, may preside with equal constancy over all the activities of his brain, directing all his conscious movements, actuating all his plans and motives, thus taking

possession of the temple, and making him in the highest sense a member of God's family, a son fit to stand as a representative of his Father and his Maker. Sinning man is still a son, although an erring, wandering, prodigal son. A sincere Christian is a son returned to his father's house, recognized as a dutiful and obedient member of his father's family, and as a rightful heir. Luke 15:19; 1 John 3:2; Job 33:27-29.

Nature reveals to us an infinite personality, working constantly, harmoniously. The uniformity of law is due, not to the fact that the power behind is a blind, unintelligent, unreasoning force, but to the fact that the power at work in nature is possessed of such infinite intelligence that every act was perfect the first time it was done, and not being susceptible of improvement, can only be repeated. Apples are always observed to fall downward instead of upward or in varied directions, and the experience of the ages up to date has not discovered any better way for apples to fall. The very uniformity of nature is a striking evidence of the wisdom, intelligence, and power of the personality which presides at its heart.

The Two Wills.

The study of the human body which has occupied the foregoing pages of this book has clearly set before us the fact that there is in the body an intelligent power, ever at work, presiding at all the functions upon which life directly depends,— circulation, digestion, respiration,— carrying on these essential activities while we are asleep as well as while we are awake, repairing, cleansing, replacing, creating, pouring in a constant stream of energy and life, renewing, strengthening, building, rebuilding, all independent of the human will or personality. The regulation of the body heat, the function of perspiration, the acts of sneezing, coughing,

and other defensive acts, are all indications of the working within the body of a personality, a will which is distinct from the human will or personality, a being which shows its superiority to that of man by the fact that its vigilance is never relaxed, it "neither slumbers nor sleeps;" also in that it carries forward those bodily functions which are essential to the body's welfare, not only without the assistance of the human will, but often in spite of opposition therefrom. A man may hold his breath for two or three minutes, but he is obliged at last to yield to the instinctive demand for air. The strongest effort to restrain the movements of the chest fails. The respiratory center, or rather the will behind it, seizes the reins of control, and compels the chest to expand. One cannot by any effort of the will suppress the perspiration or produce a chill. One cannot awaken himself when he has fallen asleep, neither can he compel himself to sleep, though he may much desire to do so. Before we conclude that this will which operates within the body independent of the consciousness is of an order below that of the human will, let us recall further some of the wonderful things which it does,— the miracles of digestion and of heart action; the creation of millions of blood corpuscles every second to take the place of those which die, and the disposal of the millions of dead bodies of those which have perished; the wonderful miracles of sight, hearing, smell, taste, and feeling; and that greatest miracle of all, the building of the body itself from a minute speck of life to the adult man or woman. This will, this being, outside of the human consciousness, by means of which all these marvelous miracles are performed, can be nothing less than the power which made the worlds, and which rules the universe, a fact which Job recognized when he said,

"The Spirit of God hath made me, and the breath of the Almighty hath given me life." Job 33:4. Moses, in his wonderful song, complained of Israel that they had "forgotten God that formed them." Deut. 32:18. Job tells us that "there is a spirit in man" (Job 32:8), and Paul declares that this spirit is the Lord, the Christ, the Spirit of God (2 Cor. 3:17), and "the Spirit of God dwelleth in you." 1 Cor. 3:16.

"In Tune with the Infinite."

The human body, then, represents an instrument, a harp of a million strings, at which two players preside, the one human, the other divine; the one fallible, erring, the other infallible, unerring. When these two players move in harmony, the song of life is sweet and melodious, a symphony; when the human player strikes even one discordant note, the harmony is broken, the melody is spoiled. The one thing needful for success, for happiness in life, is to live in harmony with God, to keep "in tune with the Infinite," to make the human will conform in every purpose, in every voluntary thought or act, with God's order of life as revealed to us by the instinctive voices which speak to us from within, by the teachings of experience, and by the instruction of Holy Writ, the garnered, winnowed, spiritual wisdom of the ages. To live "in tune with the Infinite" is to walk with God; it is to be in harmony with all the laws of being, physical and mental; it is to live at peace with one's self, as well as with the world about him. "Her ways are ways of pleasantness, and all her paths are peace." Prov. 3:17.

The man whose stomach is the seat of fermentations, putrefactions, gaseous commotions, and chemical reactions, suffers burnings, pains, pangs, aches, twinges, depressions,

and miseries of various sorts. He is out of tune. He is not in harmony with God. He is at war with him, either consciously or unconsciously. The man whose mind is full of forebodings, worries, doubts, and suspicions, is equally out of tune. "Thou wilt keep him in perfect peace, whose mind is stayed on thee." Isa. 26:3. To have one's mind stayed on God is to be ever studying his will, and earnestly endeavoring to do his will as revealed to us in the Bible and the book of nature, and even in our own bodies. We are not competent to care for the temple of the body unless we study it, unless we seek earnestly to become acquainted with all its parts, and to know their several needs, and to find the divine method of satisfying them.

We are often out of tune with Heaven because we foolishly attempt to draw a line of distinction between physical duties and spiritual duties, forgetting that everything physical which has a relation to the well-being of the temple has a spiritual significance. Life is a unit, not a duality. It is impossible to divide life into a spiritual and a physical part. There is but one life, and that is the life of God. As manifested in man, this life presents various phases which we call physical, mental, moral, or spiritual; but these all spring from one fountain, and are as necessarily related as the several branches of a tree. Nothing could be more absurd than to imagine that the highest welfare of one can be secured while neglecting the interests of the others. As well might two players at a single instrument expect to produce melody by taking care to harmonize a portion of their chords, while striking discordant notes in others. Every note must harmonize. The whole human life, physical, mental, and moral, must conform to the great decalogue which is written upon the human constitution itself, and

which is revealed to us through nature, the inspired word of God, and in human experience. The highest of all human attainments is to reach a state of absolute harmony with the Infinite, to bring the truant human will into perfect accord with all the principles which govern mental, moral, and physical action, including eating, drinking, exercise, and every other physical relation of life, as well as those obligations which are commonly denominated "Christian duties," but which include but a very small part of our moral obligations.

Every intelligent human being who recognizes this great truth, the universal unity of being, the absolute and incessant dependence upon the infinite indwelling presence, will no longer be able to call some things sacred, other things common. All things become sacred. Every eating and drinking is a sacrament, a partaking of God's substance sacrificed for our sustenance. Every action will be an act of worship, for every nerve impulse sent to a muscles is but an appeal to God for help, a request for power, and there should be at the same moment a consecration for service. Man has no power of himself. Every particle of energy which he exhibits in his actions, good or bad, comes to him direct from the source of all energy, is loaned to him by God. That he is able to direct it, thus making God to serve in his conduct, whether it be good or bad (Isa. 43:24), is due to the fact that the Creator of all the universe bows his neck to the yoke of labor, carries all the burdens, performs all the toil for all his creatures, in order that each may fulfill his mission in the world as representing some divine thought or purpose, and for man especially that he may be a fit representative of the God who made him, a true witness to the world and to the universe of the power that dwells within,

a noble image of the personality which conceived him, and modeled him from clay, and animated him by making him the temple of the living God.

The Question of Identity.

When we have learned that the human body is presided over by a dual personality, a human and a divine, man and God, we are prepared to study a question which has been heretofore little discussed, apparently because of the impossibility of finding in any of the popular systems of psychology or physiology any principle upon which to base a consistent doctrine of identity. The author wrote something upon this subject more than twenty-five years ago. Within that time the thought has grown, and assumed a somewhat simpler form; but there has appeared no necessity for any essential departure from the principles then laid down. The essentials of a consistent doctrine of human identity may be very briefly stated.

What our human minds require for identification depends as much upon our knowledge of things as upon the things themselves; hence, through imperfect knowledge we may fail in our identification. For instance, we sometimes mistake one person for another. A closer acquaintance with either one or both of the individuals would have prevented the error; our knowledge was insufficient. It is not this sort of identification we must consider, but rather that absolute identification which we should be able to make if we were possessed of absolute knowledge in relation to the person or thing concerned. Such an identification presupposes complete knowledge.

In our search for the identifying principle of things or any individual thing, it must be constantly borne in mind

that the identifying element, whatever it may be, must be something which has continuousness or continuity of existence from the very beginning to the very end of the existence of the thing concerned. It does not seem necessary to discuss this proposition, for it will be apparent at once that if there should be a break in the existence of the identifying element at any point, something would be needed whereby to connect this identifying element with that of the subsequent period of existence, in order that we might know that the object concerned was the same object known in a previous period, rather than a new and distinct object. The moment we bring such another identifying principle into use, we have dispensed with that which preceded it, having shown it to be ineffective, and hence useless, and the new principle introduced must be recognized as the true identifying principle. Whatever may happen to the object identified, its identifying element must be preserved in order that it may be reproduced; otherwise there is no means of knowing that the reproduction is not a new thing.

How do we know that a certain man whom we have met to-day is the same man we met ten years ago or twenty years ago, if we knew him at that time? How does he himself know that he is the same man? There are various ways in which we assist our consciousness to make the identification, but the real reason why the man is the same is that his individuality has been preserved by a stable principle of identification. Before we can answer this question, we must study more minutely into the nature of things in general, and of the laws of identification.

All objects consist of two things,— matter, or substance, and form. In considering the world about us, we find that there are three classes of objects: first, those that change

their form without changing their substance; second, those that change their substance without any essential change of form; third, those which while changing to a greater or less extent both their substance and their form, still retain sufficient of their form or substance to connect later stages of existence with former ones. Let us notice a few objects representing these several classes.

The first class may be represented by a bushel of wheat or sand. So long as the quantity remains the same and the material the same, it matters not what form it may assume. The wheat may be in a round basket, a square box, a bag, or spread out upon the ground; it is a bushel of wheat just the same. Its substance, both in character and amount, remains the same. The identifying principle in this case, then, is the substance of the wheat. If the material were exchanged for barley or oats, we should at once recognize the change. The identification would fail. A bushel of wheat does not naturally undergo any change of substance, but it is naturally subject to change of form. We might, of course, be deceived; for the wheat might be exchanged for other wheat. Such a deception could be prevented by sufficiently close scrutiny.

Let us notice another class of objects,— that in which the substance changes, while the form remains essentially the same. A river, a lake, a community, a rainbow, a tree, are illustrations of objects of this class. A river is a stream of water flowing through the land. The water continually changes, but the river remains the same. The course may change somewhat, its banks may widen, its bed may deepen, but it is still the same river. It may flow at one moment a rushing torrent, at another it may be merely a tiny rivulet, but it remains the same river; and this is true even though

its bed may become temporarily dry. When water flows again, it is not a new river, but a resurrection, or resuscitation of the old. The river remains the same, because its form is essentially retained.

The same is true of a lake or of a community. The members of a community may in time change so that not a single one of the original members is left; but so long as human beings are associated together in that particular place, under similar conditions, the community is still alive. It might even be held that in case all the members of the community should leave at once, and other persons come in and take their places,—a day after, or a year after, or any length of time later, if they should take up the work of their predecessors as an organized, civilized community,—the community would still be the same, having been revived, or resuscitated.

The rainbow is formed by rays of light falling upon minute particles of water suspended in the air in the form of a mist or a cloud. The water particles and the rays of light are changing every instant as the cloud and the earth are moving on, but the rainbow remains the same, from the time it appears until it vanishes, because its form and its place in time and space as regards our experience remain the same.

The tree remains the same, though putting out new leaves and branches, enlarging its trunk, changing also in part, though not wholly, by the addition of new material, so that its bulk increases in time from that of the little shrub to that of a gigantic oak. It still remains the same tree. If, however, one should plant an oak in a particular spot, and ten years later should find an elm growing, he would know

that it was not the same tree, for it is impossible for trees to change their nature in such a way.

We require for the identification of any object of this class only that the essentials of the form shall be retained; that there shall be *only such change in form as naturally occurs* without artificial intervention. The change in matter, though complete, is natural, and hence does not destroy the object's identity; but an artificial or forcible change would destroy its identity, as in objects of the first class. We see, then, that *the identifying principle depends upon the nature of the thing to be identified.* Objects which naturally undergo change of form without change of substance require permanence of substance, and it is by this means that we determine their identity. Objects which naturally undergo change of substance, but without essential or entire change of form, do not require permanence of substance, and hence substance is not at all essential to their identification. It is by their form alone that we determine their identity. This class is well represented by a song. We recognize a song as the same song, though presented by a different singer and at a different place, provided only that the arrangement of the musical tones remains essentially the same; in other words, we identify the song by its form, as in the case of the rainbow. The song is the same, whether sung in America or Africa, and whether sung by a peasant or prima donna.

If we wish to determine what is the identifying element or principle in man, we must first inquire to which of the different classes he belongs. It requires little knowledge to decide that he does not belong to the first class, since the change of matter in his body is so rapid as to require him to take daily food, and in quantity sufficient to amount

to nearly his own weight every month of his life. The young child eats his own weight of food several times a month. An eminent physiologist defines man as "a stream of matter flowing through a certain form." This definition may be applied also to every animal, for all animal bodies constantly undergo a change of their constituent substance. It is generally believed that the human body undergoes a complete change of the matter composing it at least once in seven years. Whether this be true or not, it is well enough known that the soft parts of the body undergo complete change much more frequently than this. The blood changes every six weeks. Other soft tissues certainly change every few months. Life is, in fact, dependent upon this constant change of substance. Fresh matter is brought into the body; it does its work, performs its part in the "rhythmic dance of life," then falls out, giving place to other matter, which follows in its turn. The intensity of life, its efficiency, depends largely upon the rapidity with which this change takes place. The more rapid the change, the higher rises the vital tide.

We are then shut up to the conclusion that man's identity resides, not in the substance which composes his body, but rather in the form which this substance takes upon entering it. In other words, human individuality and personality are maintained, not by the continuousness of substance from birth to death, but by the preservation of those individual characteristics or qualities which are the result of special organization or construction. In other words, the individuality of the temple, and the means of its identification, do not depend upon the particular atoms of oxygen, carbon, hydrogen, and other forms of substance which enter into its walls, but

upon the form and structure of the walls, the plan and arrangement of the temple. The form is preserved, just as is the form of the river; as each particle of matter moves out, another moves in to take its place. A deep scar made upon the skin remains during a whole lifetime, notwithstanding the skin is renewed many times, for the reason that the new particles are arranged in precisely the same order as the old, so that there is no essential change of form. John Brown, grown old, is the same person as John Brown, the boy of five years, though his body has changed considerably in size and form, and has many times changed in substance.

It is interesting to note that the change in substance of the body takes place, not under the direction of the human will, but under the direction of the higher will or personality which presides in the body temple. All the processes of growth and nutrition are fortunately under the charge of this higher intelligence. "Which of you by taking thought can add one cubit unto his stature?" Matt. 6:7. This presiding intelligence, infinite in capacity of memory, sleepless, present in every cell and fiber of the entire body, is possessed of absolutely complete knowledge respecting man's form, his organization, the construction of his body. "For he knoweth our frame." Ps. 103:14. God constructs the instrument on which both the divine and the human will perform. Man mars the instrument by his bad treatment of it; but God repairs and preserves it.

The character is the record of the music which the instrument plays. A sweet and lovely character is a melody; an evil character is a succession of discords. A pure and noble character can no more be the outcome of a gross, sensual, abused, and degraded body, a damaged soul instrument,

than can a sweet melody be produced by a piano with broken keys and loosened strings. The awful jargon of many human lives seen in the domestic broils, political scrambles for office, the bitterness of theological controversies, the vice and turpitude of the slums of the cities, and the wickedness and the mental and moral misery which abound on every side, are simply the mingled discords of damaged, broken human harps which are out of tune with the Infinite, and upon which perverse human wills out of harmony with God are carelessly, furiously, passionately, thrumming the music of the lower regions, drowning the sweet psalmodies of heaven that the divine Musician still seeks to play, even on these broken harps, spoiled by the destructive misuse to which they are subjected.

The Soul of Man.

All nations which have attained any degree of enlightenment have had some belief in relation to the human soul.

This belief has always been connected with the doctrine of a future life. A chief function of the soul is the identification of the individual in the future state of existence. The soul is thus intimately associated with the personality, the individuality, the identifying principle.

The greatest of all teachers clearly recognized the soul as that upon which the future life of the individual depends. "And I say unto you my friends, Be not afraid of them that kill the body, and after that have no more that they can do." "Fear not them which kill the body, but are not able to kill the soul: but rather fear him which is able to destroy both soul and body in hell." Luke 12:4; Matt. 10:28.

Most popular beliefs respecting the soul are based upon conjecture, or a confusion of Biblical teachings, or both.

It is the studied effort of the author in this work to find a solid scientific basis for every proposition presented, and to seek constantly a basis for harmony between the teachings of nature and the teachings of inspiration. Consequently no time will be spent in combating current ideas. Divesting ourselves of preconceived opinions and prejudices, we shall simply seek to find the truth in relation to this important question.

The fact that the essential purpose of the soul is to identify the individual in the future world, to connect the experience of this life with that of the future, really leaves us scarcely more to do than to find what is this identifying element. There have been those who sought to maintain that the material substance of the body is the means of identification in the world to come. So able a commentator as Adam Clarke held this view. Nevertheless, the well-known facts of science forbid us to entertain this notion. The constant changing of the matter of the body destroys its value as an identifying element. The fact that the same matter may have successively occupied, even at the moment of death, many different human bodies, also raises an insurmountable objection to the material substance of the body as the identifying principle, or the soul of man, the essence of human individuality.

Man is not during life identified by the sameness of matter or substance, for his material make-up is subject to perpetual change, as we have seen. It is incredible to suppose that a thing which during life is immaterial for the maintenance of personality or individuality, should after death become absolutely essential. The identifying principle cannot change. Continuity or continuousness of existence is its essential element. It cannot identify the body unless

it has been with it all the time. The identifying principle in man, as we have seen, is form, organization. The sum total of individual characteristics constitutes the identifying element. The plan of the temple is its soul; not the external form, nor merely the internal arrangement, but the entire temple scheme, including the minutest details of bodily form and structure. Every brain cell, every nerve fiber, every string of the living harp, every tone which it produces, a complete description of the human instrument and every particle of its work in human acts and words and thoughts, — all these are recorded; where? — In the universal mind, in the memory of Him who said, "Before I formed thee I knew thee." Jer. 1:5. Said David, "In thy book all my members were written, which in continuance were fashioned, when as yet there was none of them." Ps. 139:16. The same power that formed David in accordance with a plan which existed before he did, carrying forward this same plan represented in David's character, his personality, remembered in the mind of God even from before his birth, can reform him in the future world, and so secure to him a future life. David recognized the existence of such a record before his birth, and the Bible in many places recognizes the existence of such a record of all human lives. Jer. 1:5; Isa. 4:3; Rev. 20:12.

God's presence in the temple gives him the minutest information possible respecting every detail of its history; not an outward act nor an innermost thought can escape his notice. Although a man may die, although his very thoughts may perish, his personality, his character, survives. Without a human brain there can be, of course, no human thinking, no human willing, no human joy or sorrow. With the death of the body the man ceases to be: the spirit of

life, the vital power which animates the dust of which his body is composed, and makes him a living soul, returns to God who gave it. The human will surrenders its authority and control. God no longer serves. Man goes to his "long home," the dust; the divine spirit which dwelt in the temple, the creative power which formed him, which cared for him during life, which shared all his sorrows, his griefs, his struggles, bore his burdens, which "knoweth his frame" in its minutest detail, survives the wreck of the body. And thus while man's body smolders in the dust, his individuality, his "life," his soul (not his human consciousness), is safely lodged in the great heart of God, awaiting that critical moment to which the ages have looked forward when a purified universe will permit of the rehabilitation of the souls of those who have loved righteousness and truth, and are hence suited to an endless life "in tune with the Infinite." Such will enter upon a state of endless spiritual human existence through the building for each of a body suited to its character, and capable of reaching the high ideals and responding to the highest purposes to which the soul in its previous state of existence may have aspired, but which, through weakness of the flesh it could but imperfectly attain.

The soul is that subtle and mysterious element which determines what shall be the individual form and characteristics of every human being, even from the earliest moment of its existence. No matter how diverse circumstances and conditions may be from those natural to the individual, if life is maintained, the characteristic features are developed and preserved. The negro infant develops into a negro man, whether born in the tropical jungles of Africa or among the snowfields of the arctic regions. We see the same principle in operation in lower living forms as well as in man in the

wonderful phenomena of heredity. Wheat develops wheat, not rye, rice, or barley, and each variety of wheat produces its own kind. In every seed there is a perfect representation of the whole plant which may spring from the seed. In the tiny acorn, though invisible to human eyes, there is a perfect representation of the giant oak which a hundred years later may tower majestically above the spot on which the acorn falls. The oak is not in the acorn, but is represented there, not as a conscious entity, but something greater. To explain its essence would be to explain life itself; to understand its mode of procedure would be to comprehend the infinite.

We perhaps cannot find a better expression for the thought than that of the eminent Dr. Höffding, Professor of Philosophy and Psychology in the University of Copenhagen, who in his lectures represents to his students the *matter* of the body as the instrument, with *life* (God) the player, while the *soul* is the music. It is not necessary that we should comprehend clearly the properties of the soul or its functions. It is only necessary for us to know that there is a soul, and that the soul is capable of preserving our individuality and identity amid all the vicissitudes of life, and that even in death, it still remains as a guarantee and a means of an individual life beyond the grave.

"If a Man Die, Shall He Live Again?"

That there will be such a future life is proved — we do not hesitate to use the word proved — by evidence which we possess within ourselves, in addition to the abundant assurance of Holy Writ. Every human instinct, mental, moral, and physical, looking toward human welfare, is heaven-implanted, is a divine voice speaking to man. For example,

the full significance of hunger is not simply that food is needed, but that there *is* food to satisfy the need. If there were not food, there would be no hunger. A kind Creator would not give to man, as a race of beings, an appetite which could never be satisfied. Hunger says, "There is food to satisfy your need; reach out your hand, and take it." The sense of thirst says, "There is water, a river of life, flowing for your refreshment; drink, and be satisfied."

The love of life is the most imperious of all human instincts. We labor, toil, endure hardships and sufferings, in order that we may live. The animal has no instinct leading it forward to a future state of existence. It lives in the present only, and provides only to meet its present needs, or those of the immediate future. Man, of all living creatures, grasps a conception of life beyond the grave; especially when he sees his present life drawing toward its close, how eagerly he grasps the hope of a life beyond. This instinct is the divine voice which answers for the race the old question, "If a man die, shall he live again?" and assures him of a life beyond the grave. This conception, this belief, is necessary for the development of that which is best and noblest in man in this life, and is essential as a stimulus to him to make the needed preparation for the next.

The apostle Paul evidently recognized that in the development of a plant from its seed, there is an exact symbol of the resurrection. In the few words in which Paul presents the Christian doctrine of the resurrection (1 Cor. 15:35–38, 42–44), we find the expression of the soundest philosophy and the truest science.

"That which thou sowest is not quickened, except it die; and that which thou sowest, thou sowest not that body that

shall be, but bare grain, it may chance of wheat, or of some other grain: but God giveth it a body as it has pleased him, and to every seed his own body."

Paul recognized the fact that the seed and the full-grown plant are one in reality, but differing in form. The living elements of the plant are not in the seed as a whole, but in the minute germ connected with it. The body of the seed dies, but the germ in which resides the living principle on which the growth of the plant depends, does not die. Through the action of the germ, the perishing particles of the grain are revitalized, quickened, or made alive, and builded into the new body the beautified and glorified form of the plant, which, though differing widely in appearance from the seed, is one and the same organism, possessing the same life, the same soul, the same individuality, hence identical with it, not through the operation of any mechanical or chemical principle, but through the direct manifestation of the power of God, whose infinite consistency requires that he should give "to every seed his own body."

It is evident, then, that the soul of man is not the human will nor the human intelligence. It is not the "ego" considered as a being or an entity, separate and apart from God, but it is personality or individuality which in life is represented by the body with which it is connected, but in death, no longer active, exists only in the mind of the Infinite, like the melody of a song which has been sung. The singing is no longer heard, but so long as the melody, the tune, is preserved, the song may be reproduced.

God knew David before he was born; David's personality was recognized before his body was formed. "Thine eyes did see my substance, yet being imperfect; and in thy book all my members were written, which in continuance were

fashioned, when as yet there was none of them." Ps. 139: 16. In like manner, David's personality, his soul, his individuality, still exists, notwithstanding David himself has been dust for thousands of years. The soul of man is his personality. The spirit of man is the divine life which animates him. "There is a spirit in man: and the inspiration of the Almighty giveth them understanding." Job 32:8.

Somnambulism.

Sleep-walking is a remarkable mental state, in which most complicated acts are executed, some so difficult, even, that the individual would scarcely undertake them when awake. A sleep-walker moves in a mechanical way, with the eyes open, yet apparently seeing nothing. His condition is generally the result of a disordered state of the nervous system, and because of the danger involved, should be overcome as soon as possible by restoration to health. In the meantime, care should be taken to watch the subject at night, so as to protect him from injury.

Hypnotism.

The so-called hypnotic, or mesmeric, state, in at least one of its stages, somewhat resembles somnambulism; another phase very closely resembles real sleep, while in still another, the subject remains capable of almost any form of activity, but moves only when directed so to do by the hypnotizer.

The idea that a person's mind may be influenced directly by another human mind is a mischievous error. It is impossible for any individual by an effort of his will to influence the mind of another person without in some way impressing him through his senses. A hypnotized person is one who has been made to believe that his will is subject to that of

another. With this belief he surrenders his own mental independence, and places himself in a state of mental vacuity or equilibrium, ready to move in any direction which may be indicated to him by the individual whose will he believes to be controlling him. The subject is not really hypnotized by the so-called operator, but hypnotizes himself by surrendering the voluntary control of his own acts, to follow the suggestions of another. There are comparatively few persons who can be easily hypnotized, and these only under conditions especially favorable. Those who are easily hypnotized are generally persons of weak will and a more or less diseased nervous system. Hysterical young women, and men of inferior mental capacity, are the best subjects.

Hypnotism is a dangerous and damaging practice, and should be prohibited by law. When frequently repeated on the same subject, it produces serious and more or less permanent injury. The fact that some benefit seems to be occasionally derived from this procedure does not justify it, for the same benefit may be obtained by different and wholly safe and wholesome means. The will of the hypnotized person is made continually weaker by repetition of the procedure, whereas his will needs to be strengthened. He should be encouraged not to trust to the will of another, but to set his own will in operation in opposition to the diseased conditions from which he may be suffering.

Nothing could be more pernicious than the doctrine that one human mind has the power to act directly upon another human mind, either present or at a distance. The human mind can be influenced by man only through the medium of the sense.

Two minds which are in tune with the Infinite will be in harmony with one another. This fact accounts for the fre-

quently observed simultaneous development of a new truth in many different parts of the world at the same time. God is everywhere. Human nature is essentially the same the world over, and its needs are much the same. Hence it is not surprising that kindred gifts from the same source of truth should come at the same time to widely separated portions of the race.

Christian Science.

This comparatively new method of treating disease has within a few years acquired a large number of followers. Doubtless many have gotten well, under the assurances and encouragements held out by the teachings of Christian Science. It must be believed, however, that those who have thus apparently received benefit from this method have not been helped by any special force or influence which it brings into operation, but by the natural healing powers of the body, which are always ready to perform wonders of healing when given the opportunity to do so. Christian Science is certainly, in the great majority of cases, a great improvement on nostrum-taking, and the following of many of the popular medical fads and fancies of the day; but the corner stone of the Christian Science philosophy is unsound, and hence the whole fabric of doctrine is, to say the least, strongly tinctured with error.

The Christian Scientist starts out with the proposition that there is no such thing as disease, and proves it thus: God is good; disease is evil. God created all things, and pronounced them good. A good God can create no evil thing, hence disease does not exist. This is very plausible reasoning, but nevertheless contains a fatal fallacy. It is true that God created all things, and also that he did not

create any evil thing; but disease nevertheless exists, for it is not a thing, but a relation of things. While God created all things, he did not create all relations. In giving man a will and the power of choice, he enabled him to establish an infinite number of new relations, evil as well as good. Disease is the outcome of evil relations which man himself establishes. Thus disease is of man's creation, rather than God's. It is the outgrowth of the violation of law, the natural consequences of sinful seed sowing.

To say that disease does not exist is as absurd as to say that profanity, murder, insanity, and depravity do not exist, when we know from daily experience that they do exist; and it may be equally shown that God did not create them, but that they are the outgrowth of evil human conduct, of man's violation of law. Our Christian Science friends seem to have overlooked the fact that a relation is not a thing. In recognizing that God created all things, we do not enter into the category of relations, which are as different from things as abstract is from concrete, as the distance between two places, or the direction of one place from another, is different from the places themselves.

Christian Science teaches not simply that God dwells in man, but that man himself possesses powers which properly belong only to God, such as the ability to heal, to perform cures at a distance, the ability to command and set in operation by an effort of the will that creative and healing power which belongs to God alone.

Pseudo Mind-Cure.

Milton must have been thinking of mind-cure when he said: —

> "The mind is its own place, and in itself
> Can make a heaven of hell, a hell of heaven."

Milton did not, however, believe that the mind can set a broken leg or make new arms shoot out from an armless trunk. In putting these words into the mouth of the fallen Satan, the great poet simply recognized the tremendous power of mind over mind, and over matter in so far as the latter may be influenced by the will and the emotions. Recent experiments have shown that the will can control the body to a marvelous degree. It is stated that if the attention be fixed upon a particular part of the body, there may be a rise of temperature in the part. If one think intently about one of his hands, for instance, the thermometer will show a slightly higher temperature in that hand. An English physician succeeded in bringing on an attack of gout in his foot, simply by persistently thinking of it and willing it.

The physical effect of fear is used by the native judge in India as a means of discovering criminals. All the suspected persons accused of theft or some other crime are brought before the judge. He orders a handful of dry rice put into each of their mouths, and makes them chew it for five minutes. Their mouths are then examined, and the man who has a dry mouth is the thief. This is a perfectly scientific method of detection; for the culprit's fear that he is going to be found out so paralyzes the salivary glands that they cannot make saliva, and hence he cannot moisten the rice.

The appetite for food often disappears under the influence of bad news or sudden fright. Despair, gloom, and despondency prevent digestion, because they prevent the activity of the glands which make saliva and gastric juice.

In these days, a great deal is said about mind-cure. There are many kinds of mind-cure, but the different mind cures may be summed up in two classes — the true and the false.

The false could not exist if the true did not. It is easy to understand that a false mind-cure may cure a false disease. If a man thinks that he has ulcer of the stomach when he has not, he may become really sick with apprehension. Such a case may be cured by a false mind-cure; by being told that he is not sick, and cannot be so; one false idea may dislodge another. But if the man has an actual ulcer in his stomach, the false mind-cure will not be likely to do him any good. Real diseases cannot be cured by false remedies.

It is true that there are many people whose maladies seem to be relieved by so-called mental-science treatment, and by the various maneuvers of mind-curists. If the disease is a real one, however, this relief is only temporary and fallacious. The disease that was "cured" one week will reappear the next, in the same or an equivalent form. If the victim is credulous enough to be led to refrain from employing rational remedies, he may even die of his mind-cured malady, as the author has personally known to occur in several cases.

Any remedy which undertakes to cure a malady without a change in the habits, or other removal of the causes which produced it, is a false remedy. Any "healer" who claims that a sick man can be cured of any disease while still violating the laws of health, maligns nature.

It is absurd to say to a man who is making a garbage box of his stomach, "You need pay no attention to diet. All you need do is to believe. Believe that the disorder is simply a bad idea, a morbid notion. Dismiss from your mind the notion that you are ill, and you will be well." The theory expressed in the following rhyme may be fascinating, but it is nevertheless false:—

"Think health, and health will find you
As certain as the day;
Disease will lag behind you,
And lose you on the way."

If thinking health would only make us well, we need never be sick. But we must do something besides think health; we must live health; we must conform to the conditions of health. This kind of mind-cure is quite as sensible as that suggested by a magazine parody on the foregoing verses: —

"Think bread when you are hungry,
And shortly you'll be fed.
Think rest when you are weary,
And you'll find yourself in bed."

If one can change the conditions of his system simply by thinking,— if by thinking he can remove a wart from his face or a corn from his toe, or cause a dislocated shoulder to replace itself,— then he might just as well think himself fed when he is hungry, or in bed when he is weary.

There is a certain class of moral maladies which require the application of mental or moral remedies. A great number of chronic invalids are sick because they think they are sick. They imagine they are suffering from diseases which they have never had. All that is necessary to cure a man of such a malady is to substitute a different belief; dislodge the thought of disease from his mind, and he will be well. A great many instances might be given of people who have been thus cured of maladies which they did not have. At the time of the Charleston earthquake there was a woman in the city who had lain in bed for eight or nine years with paralysis. When she felt the earth trembling and the building shaking, she jumped out of bed, and ran out of the house,

and, according to the published account, she was from that moment cured.

Unquestionably, many people keep themselves sick by magnifying their maladies, by fixing the mind upon the diseases of their bodies. A man imagines that his liver is torpid, and he keeps thinking about it until his liver actually is torpid. If one thinks that his stomach is disordered, and is constantly expecting bad symptoms, these symptoms are almost sure to follow. Just as one way of thinking may encourage disease, so another way of thinking may discourage disease, and encourage health. Faith is the active factor in mind-cure, be it true or false.

No doubt the fetish of the African savage and the amulets so much worn in Eastern countries, and the cabalistic words repeated by Mohammedan and Persian physicians, are in some ways helpful remedies. The Tartar physician visits his patient, and if he does not happen to have in his bag the remedy which he wishes to administer for his disease, he writes the name of the remedy on paper, rolls it up, and makes the patient swallow it, with the assurance that the demon inside will recognize it as a sort of written notice that a drug that will kill him is coming, and that he would better leave before it arrives. The patient swallows the paper pill with the greatest satisfaction and faith. If he is cured, it is through his own faith, and not through the exercise of any occult power by the Lama doctor. Much of the pill-taking and the widespread use of patent medicines rest on the same foundation.

Rational Mind-Cure.

The potent element of mind-cure is belief. Absolute, unfaltering belief is always an effective force. Belief in the

fetish of the heathen, belief in the witch doctor, the Indian medicine man, the magnetic healer, the hypnotizer, the patent medicines,— belief in these and other pretended "healers," may be sometimes capable of causing temporary cures. But it is impossible to cure a real disease with a counterfeit faith, although there may be a palliation of the symptoms. It is as impossible to accomplish this, as it is impossible to cure a real disease by the application of remedies that have no relation to the cause of the disease. An inflammation of a kidney, for instance, will continue its progress just the same, no matter what the patient believes about it. By and by the limit of endurance will be reached, and the sufferer will succumb in spite of his belief.

Rational mind-cure does not undertake to cure structural diseases by purely psychological means. Rational mind-cure does not undertake to cure diseases which are in themselves incurable, and those which require the surgeon's knife. It does not undertake to cure a tumor, for it is only necessary to cut it off; nor a broken limb, which only needs to be set. It does not undertake to reduce a dislocated shoulder which must be brought back into place by mechanical means. Rational mind-cure promises less than false mind-cure, but accomplishes more.

The basis for true mind-cure is to be found in genuine religion,— sound, common-sense religion. The prejudice against religion entertained by too many, is largely the result of confusing religion with superstition. Many intelligent persons hold themselves aloof from religious associations and activities, not because they are altogether irreligious, or because they are in heart opposed to the principles of righteousness, but because they have been educated to look upon religion as something unnatural, sentimental, sensational, or theolog-

ical. This is a most mischievous and destructive error. Religion is a natural thing. To be perfectly natural is to be perfectly spiritual. To be perfectly spiritual is to be perfectly natural. (Man's perverted state cannot be considered as his natural condition.) The foundation of religion is recognition of the fact that we are finite beings; that we are created by an infinite power that dwells in us and in all about us, that is always seeking to bring to us the very best that we can appreciate, that maintains our life, and that heals our wounds when we are injured, and our diseases when we are sick.

We are not made up of a moral part and a physical part. Man is a unity. His moral, intellectual, and spiritual life are so interwoven that they cannot be separated. Suppose that a man has a wound in his hand. He looks at it, and sees that it is slowly healing. What heals it? No physician can heal it. No surgeon can do anything, except to keep it clean and protect it, and watch over it while it is being healed. Men say, "Nature heals it." What is nature? — Nature is simply a philosophical name for God, who is the active force in nature — the "all in all."

Common sense tells us that there is an intelligence at work throughout the universe, and that this power is in us, in our bodies. We catch a glimpse of the working of this power whenever we look at a part that has been wounded, and see the skin gradually covering the surface again. If we look through the microscope, we find that this healing is being done with the most marvelous intelligence, with consummate skill. We see forces at work in cell life that remind us of an army of soldiers, movements akin to those of companies of soldiers marching and countermarching. Under the microscope, the contents of living cells are seen moving

in systematic order, hither and thither, grouping themselves after fixed laws.

The same forces that are working in gravitation, in the growth of the trees, in the lightning, in the storm, in the tidal wave, in the hurricane, and in all the great processes of nature, are at work within us.

There is as great a miracle in the purple fruit of a great vineyard as in the turning of the water in to wine at Cana. There is as great a miracle in a vast cornfield as in the feeding of the five thousand. The power that takes the little grains of wheat and kernels of corn, expands them into leaves, rears them up in stalks, and manufactures five hundred kernels out of one,— this power is just as mysterious as the power which expanded the five loaves to feed five thousand people. It is the same thing. One of these phenomena we call natural, the other a miracle, because we are accustomed to see the one and not the other. This same miracle-working power is ever at work in our bodies, creating, healing, regulating, directing, harmonizing all the mysterious forces which throb and thrill within us.

The miracles of healing and other marvelous works wrought by Christ were only a manifestation of the same creative power which is at work in the cornstalk, the grapevine, and in all the world of life about us. We do not ordinarily apply the word "miracle" to the creative energy manifested in the production of the living bread in the waving fields of grain and the vast acres of growing corn, because the phenomena of vegetable life has become commonplace through our familiarity with it, and because these are the ordinary and regular methods by which the creative hand supplies our daily needs. Nevertheless, we may with profit learn from the spe-

cial manifestations of creative power seen in Christ's miracles the lesson that the source of power is one and the same, although the manifestation is different. This view does not belittle Christ or his power, or lessen the authority or sanctity of his work, but rather lifts the ordinary operations of nature to the same level, and enables us to see in them all the active beneficence of him who made us each, who actively and constantly interests himself in our behalf in providing for our daily and constantly returning needs.

Belief in God is the basis of the true mind-cure. Belief gives rise to hope, and hope is one of the most powerful stimulants to which the body can be subjected. If a man have nothing to hope for, he must be depressed, melancholy, cheerless. The emotions have a marvelous influence over the body. We know how joy lights up the face, and makes the eyes sparkle; how despair and melancholy darken the countenance, and draw the lines down. If any man needs to have a sound basis for hope and good cheer, it is the sick man. The man who believes in God, and who knows that he cares for each one of us, has a great foundation upon which to base faith and hope.

If we believe in God, in this ever-present intelligence and ever-present will that is seeking to guide us right, that is always striking harmonious chords, that is always drawing us upward to that which is for our good, that is always leading us onward toward that which is truest, most beautiful, sweetest, and best, and to that which will bring into our lives the greatest joy, peace, and satisfaction,— if we really believe in this power within us, we shall be led by that belief to put our wills into harmony with that will, to co-operate with this divine will in doing those things that make for our own

happiness and peace. A religious life is simply a state of harmony with God.

When a man believes that God is ever present within him, and that not the smallest hair of his head may fall without God's noticing it; when he feels that there is a mighty power working within him; that he is not left to depend alone upon a fallible doctor, who makes mistakes and blunders, and makes wrong diagnoses and wrong prescriptions; that he is not left to depend upon his own poor human nature, or upon some feeble, perhaps wholly useless, remedy; that he is not left to depend upon any human agency, or system, or philosophy which may possibly prove false and futile, nor something mystical or questionable or unreasonable, but that the mighty power that made the universe is the groundwork of his hope and confidence; when he feels that the same power cares for him which maintains the sunshine, that keeps the earth turning regularly on its axis and the planets circling in their orbits, — then he knows that he has his feet upon a firm foundation; he can lift his head above the doubts and apprehensions of disease, fancied or real, and with Job can declare, "I know that my Redeemer liveth;" and with Daniel, can say, "He is the strength of my life;" "who forgiveth all mine iniquities, who healeth all my diseases." "He that dwelleth in the secret place of the Most High, shall abide under the shadow of the Almighty."

Prayer is the natural method by which the believer in God looks upward toward the Infinite, and in humble recognition of his own helplessness, puts his will in harmony with God's— places his soul in tune with the Infinite. True prayer is not an effort to inform God of something which he does not know, to persuade him to do something which he is not

inclined to do, nor to remind him of something which he might neglect, as one might infer from the way in which many Christian people pray. Prayer is the expression of a recognized need. The need may be physical, mental, or spiritual. When man cannot himself supply his need, he instinctively turns to God, who already knows, who is all-powerful, and who is ever ready to do for his creatures whatever will be for their good. The act of prayer is simply a response to the instinct which leads man to turn toward the Infinite for help, a divinely implanted mentor, by which the soul struggling in darkness and despair, recognizing its helplessness, is pointed upward toward the light, the never-failing source of help, from which his life and all his powers come. As the homing instinct of the pigeon leads it back with unerring certainty to its resting place, so the prayer instinct in man turns his face toward home, his Father's house where there is power and resource for every emergency; wisdom to solve every perplexity; sympathy for every sorrow; satisfaction for every need.

In prayer, man puts himself in an attitude to receive that which God has for him, and of which he has given him notice by putting into his heart the thought of prayer.

A man lost in a wilderness, who has exhausted all his resources to find his way, and has finally given himself up as lost, is ready to listen to any direction or suggestion which may be given him by one whom he knows to be familiar with the country, and unhesitatingly, submissively follows the instruction given. One is not prepared to pray in the true sense of the word until he has reached the attitude of mind of the lost man who is eagerly inquiring the road home. Trouble, perplexity, and distress are the means by which man is brought to his knees, by which the willful human soul is led to submission to the will of the Infinite.

Prayer, then, does not change God, but changes man. Prayer does not modify God's plans or purposes, but brings man into harmony therewith, and is an advertisement to man of what God has in store for him. Here is the physiological, the scientific basis for faith. We are certain to receive the things for which we sincerely pray, for our desire to pray is put into our hearts by the all-wise Being who knows our needs and desires to supply them, and adopts this mode of preparing us to receive the things needful for our welfare.

We must pray with the spirit and with the understanding. To pray thus is to pray in harmony with the divine will and purposes, with a desire to glorify God, and not to aggrandize ourselves or to satisfy any selfish or unworthy ambition. When the boys of a Western college held a prayer meeting, and besought Providence to give their baseball team the victory over that of a rival college, they may have prayed in the spirit, but it was not the right sort of spirit. It was a mean, narrow, selfish spirit which led them to desire to defeat their fellows in order that they might exult over their downfall, that they might demonstrate to the world their physical superiority,— the spirit the apostle Paul calls vainglory.

The very essence of Christianity is kindliness, charity, self-abnegation, "in honor preferring one another." All our petitions must be in harmony with the noble principles laid down by the apostle Paul in 1 Cor. 13:4–8. The church pastor who commended the Washburn College students for their exercise of faith, evidently forgot that God was just as much interested in one team as in the other, and that he would be in no wise glorified by the outcome of such a contest, since there was no principle of truth at stake; while

there was a very strong probability that divine temples might be damaged by violent exertions or rude jostling, or physically, mentally, or morally injured in other ways. Such a pastor would unquestionably pray that victory might perch on the banners of his countrymen, if engaged in war with another country, irrespective of the merits of the contest and of the fact that the victory could only be won by the destruction of many precious human lives, perhaps not one of whom could be justly accused of any wrong whatever in the matter at issue, and every one a temple of the living God. Such prayers are blasphemy. The only way in which they can be answered is by an awakening of the petitioners to a broader conception of God, and to better ideas of the divine system of government.

Uplifting and Depressing Emotions.

There are certain emotions, such as hope, faith, courage, love, and cheerfulness, which exercise a highly beneficial influence upon all the bodily functions, prompting good digestion, active and equable circulation, perfect assimilation. "Laugh and grow fat" is a homely adage which embodies a practical truth. Cheerfulness of mind promotes every natural function. On the other hand, fear, anger, and despondency are highly depressing emotions, the long continuance of which may produce disease through the deleterious effects of these mental states upon the action of the heart, stomach, liver, and the other vital organs.

What is Disease?

DISEASE differs from health essentially in the fact that, in consequence of some wrongdoing on the part of the individual, the harmony of his bodily functions is disturbed. We often speak of disease germs, but it should be understood that germs themselves are not capable of producing disease. It is only when the resistance of the body has been reduced by wrong habits, by the violation of divine law, by sin, that the body becomes a prey to so-called disease germs. Typhoid fever germs are incapable of injuring a man whose stomach is sound, for the reason that the gastric juice of the stomach is capable of destroying, even digesting, typhoid fever germs. The same is true of cholera germs and other germs that enter the body through the stomach. Consumption germs can do the body no harm until after the bodily resistance has been reduced by sedentary habits, inhalation of bad air, impure blood through wrong eating, and similar digressions.

Disease does not differ from health, except in the fact that in a state of disease the body is working under unfavorable conditions, and consequently is not able to perform its work properly, whereas in health the work of the body, being done under favorable conditions, is normally performed. Disease is not an entity, but a condition; it is not a thing, but a relation.

The healing process is always being carried forward in the body even in health. When one has exercised until

exhausted, he must be healed of his fatigue before he can be ready to undertake the task again. The digestion of a meal leaves the stomach in a state of congestion from which it must be healed before it is ready to digest another meal. The body is being continually worn and damaged by its work; hence it must be continually healed. This healing process is carried on by the forces within the body. We say natural forces, as they are natural, and common to all animals, but we must not forget that these natural forces are divine forces. They are the evidence of the intelligent, active presence of creative power. In disease, unusual and extraordinary injuries exist which are due to the failure of the defenses of the body. Germs produce poisons which paralyze and irritate the tissues, causing inflammation, congestion, pain, and other disturbances. The organs, overwhelmed with work, become crippled, and unable to perform their usual duties; so digestion fails, the action of the liver, the kidneys, and other excreting organs is diminished, poisons accumulate, every tissue is damaged. every function disturbed. General fever, nervous collapse, or exhaustion may be the result.

Disease is not to be successfully combated by fighting symptoms, but by the removal of causes. A man whose head aches because of undigested food in his stomach will not be relieved by an application to his head, but by removing the fermenting mass from the stomach. Headaches due to constipation must be cured by relieving the bowels of the poisonous matters accumulated there by means of an enema or other suitable means. Weakness is not to be cured by the taking of a drug which will produce the sensation of strength,— an excitant, a stimulant,— but by increasing the ability of the body to store up energy from the food, and

by the removal of the poisonous substances which paralyze the nerve centers, the primary source of energy in the body.

The true remedies for disease, or rather the true aids to recovery, are those measures which are essential to the maintenance of health, for the body in disease is essentially the same as the body in health. In disease the body requires special assistance, but not different in kind from that which it receives in health. Life is maintained by means of the energy which is introduced into the body by means of food, water, air, light, and heat. The advantages of these agents are secured by the regulation of the diet, clothing, exercise, sleep, and the various normal conditions of life.

Those means by which these natural forces may be made available in the treatment of disease are known as physiological remedies, and their use is termed physiological therapeutics, or the physiological treatment of disease. This is now a thoroughly developed and organized system, the principles of which may be grasped by any intelligent person, and utilized to a most useful extent in dealing with a great variety of common maladies. It is not within the scope of this work to undertake to enter into a profound discussion of this subject, but a few practical hints in relation to the use of physiological remedies may be of service.

The Rational Use of Water.

Water is a physiological agent. A drug is an anti-physiological agent. Water acts upon the body, and the body reacts to it. A drug does not act upon the body; the body simply acts upon the drug to get rid of it. Water applied to any part of the skin causes it to contract, and thus stimulates an internal portion associated with that part. The portion of the skin overlying the stomach is so inti-

mately associated with the stomach by the vasomotor nerves that whatever happens to the skin over the stomach happens to the stomach; that is, as regards its circulation and nerve supply.

Over the heart an area of the skin about as large as the two hands is associated with the heart. When we wish to slow the heart beat, we put an ice bag over this part of the skin, and when we wish to make the heart beat faster, we remove the ice bag. Whatever is done to excite the skin over the heart, excites the heart also. The skin overlying the liver is associated with the liver; hence, if a cold application is put on this surface, it contracts the blood vessels of the liver; but if a hot application is made to the skin, it dilates the blood vessels. Therefore, if the liver is congested, the blood can be removed; and if its vessels are obstructed, healthy blood can be made to pass through it, and it will be healed, for it is the blood that heals.

When one feels drowsy, if he bathes his face in cold water, he will be aroused.

If a person has an internal congestion or inflammation, we may put him into a tubful of hot water, and the heat will dilate the surface vessels, and will thus bring the blood into the skin in such quantities that the inflamed part will be drained of the surplus blood, and thus relieved. This is the simplest thing in the world.

Here is a man whose heart is running away. Alcohol may be given him to slow the heart. How long will it be before the alcohol reaches the heart? — It must be first taken into the stomach, absorbed, circulated, and distributed all over the body; it goes to the head and the heels and all the places between, and the heart gets only a little of it. If we put a cold application over it, that very instant the heart

feels the influence of the application. Why? — Because the impulse travels over the nerves directly to the heart, and it goes at the rate of two hundred feet a second. How far is it to the spinal cord? — About a foot. And how far is it to the heart? — Say a foot. That is two feet to the spinal cord and back to the heart. So it requires only one one-hundredth of a second before the cold applications begins to do its work.

Suppose a person faints away, and falls upon the floor; we have only to dash a little cold water upon the patient's face, and the heart begins to beat again, the chest expands, the eyes open, and the patient lives.

Every case in which an organ has ceased to do its work is in a certain sense a case of fainting. Here is a stomach that has fainted away at the descent of an enormous dinner; the poor stomach is unable to do its work. What is to be done? Shall we swallow pepsin, the digestive principle from a pig's stomach, or some stimulant? Better apply a hot fomentation over the stomach, followed by a short cold application and massage. The stomach is energized by the applications, and goes to work.

So it is with every bodily organ. If one knows where to apply the water, hot or cold, as the case may be, he can wake up any organ of the body. Water is a remedy that will revive a sluggish organ almost instantly. It is an almost universal remedy, and it is well to know how to apply it in simple cases.

Malarial disease is curable by quinine. This is a parasitic disease, and the quinine kills the parasite; but it does not cure the man, because he succumbs to the disease again if he is exposed to a new infection. Water operates differently. By cold water properly applied, the strength and vigor of the body are increased to such a degree that it is able to

destroy the parasites without the quinine, and then it becomes a dangerous place for them. Cold water renders the body uninhabitable to the parasites, while quinine acts simply as a temporary palliative. Cold water is not an infallible remedy for malaria, but a most valuable preventive.

Hydrotherapy and Hot Weather.

Cold is a universal antidote for heat, as heat is for cold. We use water to put out fire, and fire to warm cold water. There are no disorders or morbid conditions which so readily respond to the use of water, and which are so radically and readily benefited by hydriatic applications, as those especially incident to hot weather. The public generally have found this out, and hence it is a custom in many countries, even in lands where the remedial use of water is not well understood, to make a summer trip to the seaside to get the benefit of the hydrotherapy of the sea.

Sea bathing, which from the most ancient times has been considered a great health promoter, is wonderfully beneficial to thousands. And what is true of sea bathing, is also true of lake bathing, river bathing, and bathing in natural sources of water of all kinds. We must remember, however, that what is good for one person is not always good for another, and many are injured by sea bathing, through ignorance.

Cold Bathing.

Very frequently people are made sick at the seashore by too long bathing. Some spend hours in the surf, and become completely exhausted. If one is unaccustomed to sea bathing, the duration of the bath should at first be not longer than two or three minutes; the next time it may be a little

longer, and may gradually be lengthened to ten or fifteen minutes. If the water is rather cold, one should not remain in more than five or ten minutes; if it is very cold, not more than three or four seconds,—just long enough to get the impression of cold upon the skin. Fleshy people can remain in the water longer than thin people, and adults longer than the very young.

The benefit to be derived from sea bathing is due, first of all, to the low temperature of the water, the temperature of sea water seldom being above 70° or 75° F. Water at this temperature very rapidly extracts heat from the body, so that if a person remains in water at that temperature a very great length of time, he loses considerable heat. So large an amount of heat may be carried off in this manner that one will suffer from shock, and the next day he may feel great depression as the result. Fresh water is usually warmer than salt water; but in salt water, reaction occurs more quickly than in fresh water, so that one may remain in it a little longer. The reaction after a cold bath should always be prompt and complete.

Cold has the marvelous property of increasing vital work of all kinds. When cold water is applied to the skin, impulses are sent inward that awaken every organ of the body. Let us see what takes place: When a person dashes into cold water, the first thing he does is to draw a deep breath; the lungs swell out, a deep inspiration is taken, and the heart begins to beat with wonderfully increased vigor and strength. This deep breathing is purely involuntary, just as is the jerking of the leg when the bottom of the foot is titillated; it is one of the organic functions carried on by the bodily forces entirely independent of the will.

This deep breathing increases lung activity, thus bring-

ing in more oxygen; it increases heart activity, so that the blood is circulated with greater force; hence we have more blood and purer blood carried into every tissue of the body. The result is a stirring up of the bodily forces, and a distribution throughout the system of a larger amount of highly vitalized and oxygenated blood. Thus we see that the blood-making powers of the body are increased by sea bathing or by the application of cold water in any form.

Another very important activity which is increased by the application of cold or by cold bathing is the digestive function, by which the food is absorbed and taken into the blood. The application of cold water to the skin has the effect to stimulate the secretion of gastric juice. Every one knows the effect of taking a walk on a cool morning, or of sea bathing — what an appetite it gives. Digestion as well as appetite is wonderfully stimulated by cold. That is why the Eskimo can live on blubber and other food the digestion of which would be quite impossible to the ordinary stomach.

Cold air stimulates the formation of gastric juice by the peptic glands. The liver and the salivary glands are stimulated in the same way.

All the functions of the body are stimulated by a general application of cold water or cold air.

The Neutral Bath.

The neutral bath is a full bath at a temperature of from 92° to 95°. In cold weather a little warmer water may be used than in summer. The neutral bath is an excellent remedy for sleeplessness, and for nervousness in both adults and children. A long neutral bath is an excellent means of antagonizing the effects of excessive summer heat.

Sunstroke and Overheating.

Suppose one has been overheated, or had an attack of sunstroke; what is to be done? Water is the life saver, the best means in the world of rescuing one from the effects of sunstroke or overheating. Hippocrates, who lived three hundred years before Christ, had a very simple method of treating people for sunstroke. His plan was to have one person pour cool water on the patient, while two or three others rubbed him vigorously. The application of cold water alone is dangerous, because it drives the blood inward; but when cold water is applied, and accompanied by vigorous rubbing, the blood is kept at the surface, and the body is rapidly cooled.

When sunstroke is about to occur, there is an elevation of temperature, the skin is dry, and the man stops sweating, so that there is no evaporation. But perspiration, the evaporation of which is constantly cooling us off, carries away the heat of the body so rapidly that the temperature does not ordinarily rise above 100° (98.5° in the mouth, or 100° in the interior of the body). This is the temperature at which the vital processes are naturally carried on, and if the temperature rises above that, there is usually disease. At a temperature of 107°, death occurs quickly; at 110°, very quickly. If we apply cold water to the skin, and at the same time rub the surface vigorously, this brings the blood into the skin, and keeps it there, thus encouraging the cooling off.

Sunstroke is a very dangerous accident, and is likely to prove fatal without proper treatment; but by the aid of cold water poured from a height of five or six feet, the water being about 60° or colder (ice water, if you can get it), and

with two or three people rubbing the patient vigorously, we may expect a cure in almost every case. Especial pains should be taken to wet the head and back of the neck, and to keep these parts cool. Continue the rubbing both until the skin is well reddened and consciousness restored.

Stomach Disorders.

Hydrotherapy is the best remedy for the stomach and bowel disorders so prevalent in the summer. Cold applications to the abdominal surface are almost a panacea for excessive activity of the bowels. The reason is that the blood vessels of the congested parts are made to contract. A hot enema should be given for cleansing the bowels and stimulating the circulation. A cold compress to the abdomen, changed every hour or two, affords great relief. If there is pain, a fomentation should be applied for fifteen minutes, followed by the cold compress, to be changed every ten or fifteen minutes; it must be allowed to warm up, and then be changed. This keeps a current of vitalizing blood flowing through the part. By the cold application there is a contraction; and then as the blood warms up, there is a reaction and a crowding out of the blood. When the cold compress is applied again, there is another contraction, then as the compress becomes warm, reaction again takes place, and another crowding out of the blood; at each time fresh blood comes in, and the white corpuscles are enabled successfully to combat the parasites and to carry them off.

The Hydriatic Treatment of Typhoid and Other Fevers.

It is not the purpose here to discuss fully the treatment of typhoid fever, but only to give a few brief hints about the use of water in this very common and very grave disease. Under ordinary treatment, the mortality from this disease is

about twenty to the hundred. Under skillful treatment by baths, the mortality has been reduced to two or three per cent and even less.

First, let us remark the importance of water drinking as a means of washing out the poison through the kidneys and the skin. The patient must drink half a glass of water every hour when awake, and more if he will, and whether he is thirsty or not. He does not drink to quench thirst, but to cleanse the blood from the typhotoxin and other poisons produced in this disease. The water may be advantageously flavored with fruit juices of various sorts, but should not be sweetened with sugar. If the patient will not drink, an enema at 80° F. must be given three times a day, and retained as long as possible. An enema to cleanse the bowels must be given daily besides.

The fever is best controlled by the cooling wet-sheet pack.

Headache is best relieved by the head compress, changed as soon as it begins to warm, and an ice collar about the neck, or a towel wrung out of ice water.

The cool abdominal compress must be applied from the beginning of the disease during its entire course.

For the cough, which is sometimes troublesome in typhoid, apply a chest pack, as shown in accompanying illustrations.

If the patient becomes delirious, the prolonged wet-sheet pack or the long full bath at 92° F. will afford relief. The bath may continue from half an hour to an hour or even longer. The patient must be gently rubbed from time to time, to prevent chilling. When the pack is employed, the wet sheet should be changed as soon as it becomes warm, and repeated until the patient's temperature falls, an hour or more if necessary.

a. WET GIRDLE, FLANNEL COVERING.

b. FOOT BATH.

c. ROLLER CHEST PACK.

d. COLD MITTEN FRICTION.

WET SHEET RUB — APPLYING SHEET.

WET SHEET — RUBBING.

The diet in typhoid fever should be grape juice or fruit juice of some sort, with little or no cane sugar, for the first three to six days. Then cereal food, such as zwieback, granola, granut, browned rice, or malted nuts, may be added. Avoid beef tea and milk. Fresh, ripe strawberries, baked apples, prune purée, and fruit soups are most wholesome for the fever patient. A competent physician must be employed.

Useful Hints for the Local Application of Water.

A very cold compress, as a thick folded towel, or a mass of cheese cloth, applied to the head and face, will relieve headache when the head is hot. The hair should be wet, and if the case is obstinate, apply an ice collar around the neck. Change the compress as soon as they begin to become warm.

A cold compress applied to the abdomen in typhoid fever during the entire course of the disease will prevent ulceration and hemorrhage in nearly every case. The compress should cover the whole abdomen, should be wet in water at 60° F., and must be changed every twenty to forty minutes, according to the degree of fever, or as often as it becomes well warmed.

For weak or failing heart, apply a cold compress over the heart (60° F.) for fifteen or twenty minutes, and repeat every hour.

For inflammation of the lungs, apply a cold compress (60° F.) over the whole front part of the chest and the affected side, and change every fifteen to twenty minutes, or when well warmed. Apply a fomentation for ten minutes once in two or three hours, or more often if pleurisy pain is present. Keep the legs and general surface warm.

An acute coryza, or cold in the head, with sneezing, and running at the nose, may often be cured in a night by wetting

the hair, and putting on an oil-muslin or mackintosh bathing cap to be worn overnight.

For a severe pain due to inflammation in the hand or finger, immerse the elbow in cold water.

For a lung cough, apply the chest pack. There is no other remedy so effective, and at the same time harmless, as the chest pack. The compress should warm up at once and keep warm.

For a sleepless man, who has too much blood in his head, there is nothing better than a bath at 92° F. for thirty minutes at bedtime, and a wet girdle to be worn during the night. The girdle is a towel long enough to reach once and a half around the body, wrung dry out of cold water, and covered so it will warm up quickly, with a thick woolen bandage.

For a "crick in the back," a large fomentation applied at bedtime and followed by a towel wrung out of cold water and covered warm with flannel to remain overnight, is worth a hundred porous plasters and all the liniments of the pharmacy, "pain-killers," "wizard oils," "kidney pads," "electric belts," and all the rest of the quackish ilk.

For pain in the eyeball, apply a light fomentation over the eye and forehead, just above the eye, not the cheek.

For colic pain, give a hot enema, apply a fomentation, and afterward a wet girdle for an hour. Repeat this procedure if necessary.

Pain in the pelvis is almost always relieved by a very hot foot bath, which relieves the congestion by diverting the blood into the legs. A hot hip and leg pack is still more effective.

A Retiring Bath.

If one is exhausted by a hard day's work, what is the best thing to give relief and to secure a comfortable night? — A hot bath, beginning at a temperature of from 102° to 104°, at bedtime, cooled after one minute to 92°. Lie in this neutral bath until you feel sleepy, then rouse yourself, roll into bed, and you will have a comfortable night's rest. A hot bath refreshes the system, stimulates the elimination of fatigue poisons, relieves irritation, and secures a comfortable condition for sleep.

The Tonic Use of Water.

Water is the universal tonic, but for tonic effects, must be applied cold. There are several ways in which cold water may be applied for producing tonic effects. The most efficient are the cold towel rub, cold mitten friction, wet-sheet pack, the cold shower bath, and the shallow bath.

The best time for taking a cold bath for general tonic effects is just after getting out of bed in the morning, when one is warm from the bed. A cold bath should never be taken when one is chilled. One not accustomed to cold bathing should begin carefully. The water should not be very cold at first; 75° F. is cool enough. By gradually lowering the temperature, water at 60°, even lower, may be applied. The bath must be short, not to exceed a minute, and for feeble persons not more than fifteen to thirty seconds when the water is applied to the whole surface. The bath should be immediately followed by rubbing and exercise for fifteen to thirty minutes. There should be good reaction; that is, the whole surface, including the hands and feet, should quickly become warm. The bath should not be followed by languor, headache, lassitude, or other indications of exces-

sive reaction. When one experiences symptoms of this sort, the indication is that the bath was too long or too cold, or that it was not followed by sufficient rubbing or exercise. The bath should not be given up, but should be continued with the necessary amount of modification. The cold bath should be taken by every person every day. The following is a brief description of the best methods of taking tonic baths: —

In order to obtain efficient tonic effects, the water must be applied at a low temperature, and the application must be brief. There are several convenient methods of application which may be employed. When a bath tub is accessible, an excellent means is as follows: Draw into the tub cold water to the depth of three or four inches. In the summer time water as cold as can be obtained from the pipe should be employed. When in winter time the temperature of the pipe water falls as low as 40° to 45°, most persons will find it advantageous to raise the temperature to 55° or 60° at least, and for feeble, young, or elderly persons, a higher temperature, 65° to 75°, is essential to avoid ill effects from deficient reaction of over-stimulation.

Care should previously have been taken that the bath room is suitably warmed, so that reaction after the bath may not be hindered. Disrobe quickly, and, standing at the side of the bath tub, bathe the face, neck, arms, and chest. Then step into the tub, and sitting down in it, rub first the legs, then the chest and abdomen, applying the water freely to all parts of the trunk which can be reached. After five or six seconds, lie down in the tub long enough to count five, rubbing the sides of the body at the same time. Then, rising to the sitting posture again, renew the rubbing of the limbs and trunk. The sitting and the lying position may thus

be alternated several times, vigorous rubbing being continued the whole time. It is well to continue the bath until evidence of reaction appears in reddening of the skin. Those who are not strong enough to endure so long an application should rub the moist skin, after leaving the bath, until reaction begins.

After the conclusion of the bath, the whole body should be covered with a sheet, preferably a Turkish sheet, so as to prevent chilling by evaporation; then by vigorous rubbing, the skin should be dried as quickly as possible. Reaction should be further encouraged by rubbing for one or two minutes with a rough towel. Then dress quickly and exercise actively for fifteen to twenty minutes, or until reaction is thoroughly established. If the hands and feet are cold after the bath, it is evidence that reaction has not been perfect. The internal parts have been left congested, and harm rather than benefit has been received.

Those who are well accustomed to the cold bath can without inconvenience enter a well-filled tub; but for those whose ability to react is not very great, it is better to employ a smaller amount of water.

When the bath is supplied with an overhead shower, this may be employed, if preferred, instead of the rubbing shallow bath. The water having been adjusted at the proper temperature, which should not be higher than 70° (much more powerful effects are obtainable at 45° or 50°), the bather, having disrobed, stands by the bath tub, and allowing the water to fall upon his hands and arms, bathes the face and neck, then enters the bath for half a minute to two minutes, rubbing the skin vigorously all the time, especially the part upon which the water is falling. After the bath, the patient should quickly dry himself, and exercise as above directed.

For feeble persons who cannot safely receive so vigorous an application, and for those who do not have access to a bath tub, the cold mitten friction or the cold towel rub may be employed. The cold mitten friction is applied by the aid of a cloth sack something like a mitt, but made without a thumb, the whole hand being introduced. This is wet in cold water, and then applied to the surface with vigorous rubbing. It is applied first to the chest, which is rubbed until red. The part is then dried and rubbed. One arm and then the other, and in succession the abdomen, the legs, and the back receive attention, until the whole body has been gone over. Assistance is required for the back.

The cold towel rub is applied by means of an ordinary linen towel, which is wrung out of cold water, shaken out, and applied to as large a surface as it will cover. It should be applied first to the front of the body, then to the two arms, the legs, and the back successively, care being taken to dry and rub each part until it is well reddened before proceeding to the next.

Persons who are fairly strong, and those who have been accustomed to cold bathing, so that they are able to react well, may employ the wet-sheet rub. One or two assistants are needed for this bath. A sheet is wrung out of water at the proper temperature (60° to 70°), and quickly wrapped around the bather, as shown in the accompanying cut. The assistant then vigorously rubs the sheet upon the outside until it becomes warm. A dry sheet is then applied, and the patient well dried and rubbed until reaction is well established.

Inflammation is generally due to infection by germs. The most important thing to be done is to increase the resistance of the body and the blood supply of the inflamed part.

At the beginning of the inflammation, when the process is very acute and painful, an ice bag should be applied over the affected part. At the same time hot applications should be made to the lower extremities. This may consist of a hot blanket pack for fifteen or twenty minutes, followed by a heating compress, consisting of towels wrung out of water at a temperature of sixty degrees, covered first with mackintosh and then with flannel. When ice bags are employed, they should be removed every half hour for five minutes. The application of the fomentation aids in producing a vigorous reaction, thus preparing the skin to react promptly when the ice bags are applied. All internal inflammations are treated on essentially the same plan.

Drugs Which Enslave and Kill.

ALL drugs which produce so-called medicinal effects are more or less harmful and destructive to health and life when habitually used. They excite nervous or other forms of vital action without affording support for the same. Food promotes vital activity, while at the same time sustaining or furnishing material to supply the waste resulting from vital action. This is the difference between a food and a drug.

Various drugs create a sensation of strength or warmth which is unreal. The apparent warmth is only the hiding of the real condition by benumbing the temperature nerves, and the apparent strength is due simply to the obtunding of the nerves which report weariness or exhaustion. To rely upon a drug of any sort for artificial aid is a fatal mistake, the result of which will sooner or later be physical, probably also mental and moral, bankruptcy. Very rarely indeed is it justifiable to make use of drugs for the relief of pain; then only when a transient effect is desirable, as in the use of anesthetics. Chronic as well as acute pains generally yield quite promptly to the use of measures which remove the cause of the pain. In hopeless cases in which the cause cannot be removed, and the pain is unendurable, narcotic drugs find a useful place as a boon to despairing, suffering humanity.

It is a singular fact that certain drugs, particularly those which are capable of producing pleasurable sensations or an artificial state of well-being, have come to be quite widely used by human beings, civilized and uncivilized. The best known

and most widely used of these are alcohol, tobacco, tea, and coffee. There is not space in this work for a full discusssion of the various question which have arisen respecting these drugs; but their use is so common, and the damages resulting therefrom so extensive, that the author feels it important to present at least a summary of the more important points relating to the injurious effects resulting from the use of felicity-producing drugs.

THE EVIL EFFECTS OF ALCOHOL.

Alcohol, the essential constituent of all fermented and intoxicating liquors, is an ancient foe of the human race. From the time Noah fell into shame and disgrace through the intoxicating effects of wine, alcohol has never ceased to be an enemy of mankind. Like the arch deceiver himself, alcohol, one of the devil's most efficient agents for destroying the happiness of man, both for the present and the hereafter, gains the confidence of its victims by making great promises which it never fulfills.

Alcohol promises pleasure; but instead of true pleasure, happiness, and contentment, which come from a life of sobriety and uprightness, it gives a mere transient tickle of the palate, a thrill of the nerves, a momentary exhilaration, a transient oblivion, and after it the bitterness of a ruined life, loss of friends, home, and property, a wrecked body, premature death, disgrace, and misery. Alcohol promises comfort; but instead of the comfort and well-being which come from health, strength, and vigor,— the result of a wholesome life,— alcohol gives simply a temporary benumbing of the sensibilities, certain to be followed by an increase of pain and suffering, and an aggravation of all the miseries which it promises to relieve.

The weary man takes a glass of intoxicating liquor for the relief of pain, a weakness of the nerves, a sinking at the stomach, a general discomfort. His misery disappears. He congratulates himself that he has a never-failing remedy, a panacea upon which he may always rely. But he soon finds that his malady, his misery, is aggravated instead of cured. His weak nerves, when the influence of the liquor is gone, are weaker than before. He is completely unstrung. More liquor is required to put to sleep his crying nerves and to relieve his discomfort.

Alcohol is in every way a deceiver. It fulfills none of its promises. It relieves hunger because it destroys the appetite and the power to digest food; but it does not nourish the body. It destroys pain by paralyzing the nerves; but it does not remove the cause of the pain. It makes the poor man feel for a brief time that he has boundless wealth; but it leaves him poorer than before. If a man is cold, it gives him a sensation of warmth; but he is actually colder than before. The man who is weak imagines he is strong, while he is actually weaker than before.

In the following pages we shall present in a brief and concise manner the facts which modern scientific discoveries and the experience of the race have shown to be true respecting alcohol — facts to whose truth the most eminent scientific physicians throughout the world will bear witness.

Alcohol Is a Chemical Agent.

It is colorless when pure, and very inflammable, burning with a pale, blue flame. It is closely allied to such chemical compounds as naptha, turpentine, benzine, fusel oil, kerosene, and burning fluid. It is seldom found pure, usually containing from two to fifty per cent of water, besides various impu-

rities, chief among which is fusel oil, another variety of alcohol. The active chemical properties of alcohol render it not only unfit for introduction into the body, but actually dangerous when in a pure state. It destroys instantly all living tissues with which it comes in contact. Absolutely pure alcohol is almost as destructive as caustic when brought in contact with unprotected living tissues.

Alcohol Comes of a Bad Family.

"A man is known by the company he keeps." This adage is equally as applicable to some other things as to men. It holds good respecting alcohol, at least. There are numerous alcohols. Fusel oil, a constituent of bad whisky, is one; naptha, or wood spirit, is another; carbolic acid and creosote are chemical substances which are related to alcohol. The chemical composition of these substances is closely allied. They all belong to the same general family of chemical compounds, and are so presented in works on chemistry.

Alcohol Is a Poison to Plants.

Vital properties are very much the same in a general way, whether manifested by a mushroom or a man, and any substance which will destroy the life of a plant is not likely to be wholesome for human beings. If a plant be watered with a weak solution of alcohol, its leaves soon wither, turn yellow, and the plant dies, even when the proportion of alcohol is so small as one part in one thousand parts of water. When a sundew is exposed to the vapor of alcohol, it quickly becomes stupefied and incapable of manifesting its wonderful ability to catch small insects. Prolonged exposure to air saturated with the vapor of alcohol destroys the life of the plant.

Alcohol Is a Poison to Animals.

A tadpole dropped into a vessel containing alcohol will die in a minute. Leeches and other small animals succumb in like manner.

A French physician administered alcohol in the form of brandy and absinth to fowls. The animals took kindly to the use of stimulants, and soon became so addicted to them that it was necessary to limit them to a daily allowance. In two months absinth drinking killed the strongest cocks; the brandy-drinking fowls lived four months and a half, while the wine drinkers held out three months longer. But finally all died the death of the drunkard. The late Professor Dujardin-Beaumetz, one of the leading physicians of the world, in experiments upon pigs, found its effect to be uniformly that of a poison.

P. Cololian, an eminent European investigator, has recently shown by experiments on fish that all the alcohols are deadly poison. Ten to fifteen parts of ordinary alcohol in one thousand parts of water very promptly produced deadly effects on the fish immersed in the solution. Ethylic alcohol, or wood naptha, was found to be less poisonous than ordinary alcohol. This investigator also pointed out the interesting and impressive fact that while certain poisons, such as nicotine and atropia, may be taken by certain animals, as rabbits and goats, without injury, alcohol is a universal poison. It kills everything with which it comes in contact, animal or vegetable.

Alcohol Is a Poison to Human Beings.

Notwithstanding the apparent impunity with which diluted alcohol in the form of various liquors may be taken, pure alcohol is rapidly and certainly fatal when taken into the

stomach without dilution. Cases of instant death from drinking a considerable quantity of strong liquor have often been recorded, and numerous cases of death from this cause are constantly occurring in every large city. Alcohol in every form is a poison, the rapidity of its effects being largely determined by the degree of dilution in which it is introduced into the system.

Alcohol Is a Narcotic.

Alcohol is exciting in its first effects; but like most other substances of similar nature, its secondary and more prominent effect is narcotizing. It benumbs the sensibilities. Persons who have died from the effects of an overdose of alcohol, present all the indication of narcotic poisoning.

A tablespoonful of strong alcohol held in the mouth for two or three minutes will obtund the sense of taste so as to render a person unable to determine between sweet and sour, saline and bitter. If taken in sufficient quantity, it will relieve the sense of pain sufficiently to enable a surgeon to perform an operation with little or no suffering on the part of the patient. Ether and chloroform are made from alcohol. Alcohol, like ether, is an anesthetic.

Alcohol Not a Food.

The aristocratic toper who wishes to give an air of respectability to his vice, will claim that alcohol is a food. The fact that individuals have in several instances been known to live from thirty to sixty days while taking only water, shows conclusively that those persons who lived a shorter time on brandy

and water, lived in spite of the alcohol instead of by the aid of it.

After repeated refutations of the idea, it is strange that people should still cling to the notion that lager beer is nourishing. If a man has lost his appetite, and seems to be failing in strength or losing weight, his next-door neighbor advises him to drink daily a few glasses of lager beer. If a nursing mother has insufficient nourishment for her infant, wise old ladies prescribe lager beer or ale.

Professor Baron Liebig, a German chemist of great renown, says, "We can prove with mathematical certainty that as much flour or meal as would lie on the point of a table knife is more nutritious than five measures (ten quarts) of the best Bavarian beer." Powerful nutriment, indeed!

Water is the *only drink,* that is, the only liquid capable of supplying the demand of the system for fluid. The various beverages in common use are of value only to the extent that they contain water, the universal solvent. Alcohol, then, is neither food nor drink. It satisfies the craving for food, but does not replenish the tissues. Although a liquid, instead of supplying the needs of the system for liquid food, alcohol creates a demand and a necessity for more.

Scientific medical men the world over are now practically agreed that alcohol cannot be considered in any proper sense a food. It is never assimilated, that is, it never becomes a part of the body. The mere fact that it is burned, or oxidized, in the body, thus serving to economize heat or heat-making substances, does not constitute it a food. The same may be said of a great number of chemical substances, none of which would for a moment be accepted as a food, as, for example, fusel oil, wood naptha, ether, chloroform, opium, and various other drugs.

Alcoholic Degeration.

Degeneration of the muscles, heart, brain, nerves, liver, kidneys, and in fact all the organs of the body, is induced by the habitual use of alcohol. Dr. Carpenter is authority for the assertion that the changes in the corpuscles and in the fibrin of the blood take place when not more than one part of alcohol to five hundred of blood is employed. Thus it will be seen that the very weakest wines are unsafe, since none of them contain less than from three to five per cent. Even small beer and cider might be capable of doing mischief in this way, if taken in sufficient amount, and may be the cause of far greater mischief by leading to the use of strong drink.

The Drunkard's Brain.

The brain, when in a normal condition, is so soft that it would not retain its exact form but for the support of the skull. The sharpest knife is required to cut it without mangling its structure. It is necessary to immerse the organ in alcohol for weeks or months in order to harden it, when a careful examination is essential. A drunkard's brain presents a marked contrast. It is already hardened. A celebrated anatomist declared that he could tell a drunkard's brain in the dark by the sense of touch alone.

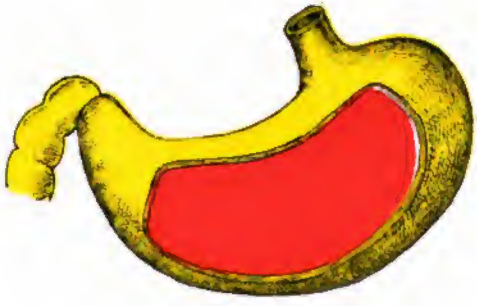
By means of delicate instruments it is possible to measure the exact length of time it takes a person to feel, to think, to see, to hear, and to act. A careful experiment made by the author for the purpose of determining the influence of alcohol upon these various senses and upon mental activity showed that the length of time required was more than doubled as the result of taking two ounces of whisky. This clearly

shows the paralyzing influence of alcohol upon the brain and nerves.

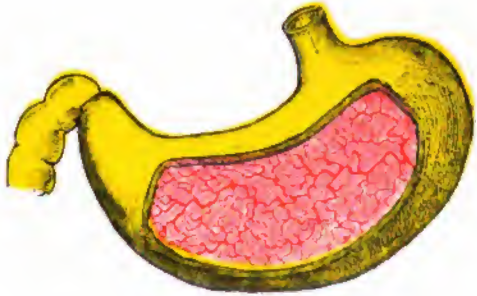
Recent researches have shown that when alcohol is introduced into the circulation, some of the delicate nerve cells almost immediately become shriveled, misshapen, and incapable of performing their duty. The delicate arms by which the nerve cells come in contact with each other, thus making possible the various functions of mind, memory, reason, judgment, etc., become retracted so that the contact of the various cells is more or less completely interrupted by the changes in shape which take place, and irregular and abnormal contacts may be made. This fact explains the delirium, hallucinations, and other mental disturbances, as well as changes of character, which occur in those who make free use of alcoholic beverages. That these changes occur is not a matter of theory or supposition. Experiments upon living animals have shown that these changes, which are illustrated in the accompanying cuts, actually occur, and within so short a time as fifteen minutes after the introduction of alcohol into the system of the animal. After the recovery of the animals from the effects of the intoxicating dose, the cells regain their normal appearance; but when the use of alcohol is habitual, large numbers of the cells and the brain, mind, and character become permanently damaged.

The Drunkard's Stomach.

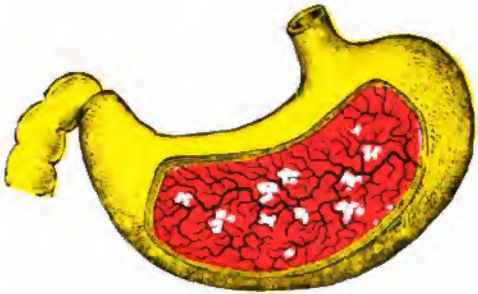
A microscopical examination of the lining membrane of the stomach shows it to be traversed by a dense network of blood vessels, which are wholly invisible so long as the organ remains in a healthy condition. Little pockets are also found in which are located the peptic glands which form the



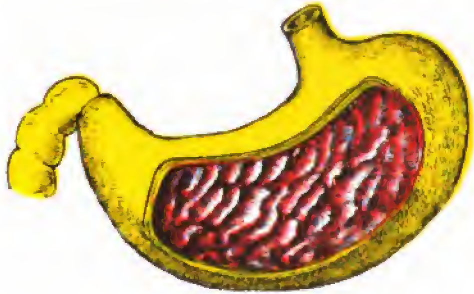
A HEALTHY STOMACH.



THE STOMACH OF A MODERATE DRINKER.



THE ULCERATED STOMACH OF AN HABITUAL DRUNKARD.



THE STOMACH IN DELIRIUM TREMENS

gastric juice, the essential agent in the process of stomach digestion. In the small intestine below the stomach we have a similar arrangement of blood vessels and glands.

In the well-known case of Alexis St. Martin, who suffered from a gunshot which carried away a considerable portion of the abdominal wall, and penetrated his stomach, leaving an opening after healing, Dr. Beaumont made some most interesting experiments regarding the effects of alcohol upon the stomach, with the following results: —

The Stomach of a Moderate Drinker.

The effect of alcohol, as well as of condiments, was to produce a state of excitement and irritation in the stomach, the result of which, when frequently repeated was permanent congestion and numerous forms of dyspepsia. But alcohol does more than simply irritate the stomach. By its narcotic influence, it paralyzes the glands of the stomach, while by its chemical properties, it destroys the activity of the gastric juice. It thus does triple mischief.

The Stomach of a Hard Drinker.

In the stomach of the hard drinker the blood vessels are dilated as in the case of the moderate drinker, and in addition, small ulcers are seen scattered over the diseased surface. The stomach of an old toper may be in an ulcerated condition without his being conscious of the fact, as the nerves of the stomach are so paralyzed by alcohol that their normal sensibility is quite lost.

The Stomach in Delirium Tremens.

In a person who is suffering with delirium tremens, or acute alcoholism, the mucous lining of the stomach is in a state of intense inflammation, so that its functions are wholly sus-

pended. Dr. Beaumont observed on one occasion, when Alexis St. Martin had been drinking heavily for a few days, that although his stomach was in a state of inflammation and ulceration, he was unconscious of pain, and felt no local inconvenience, only suffering from a severe headache.

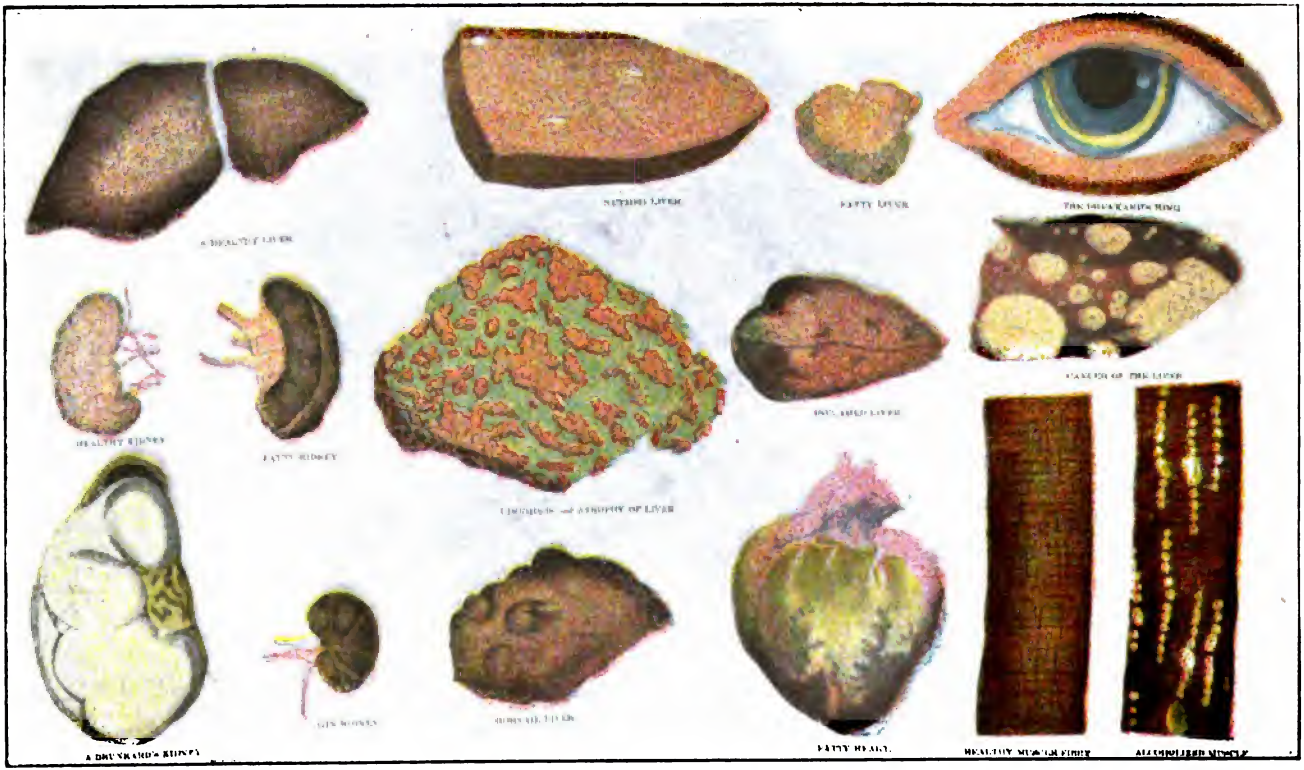
Post-mortem examinations of persons who have died of delirium tremens have disclosed the fact that the stomach has been the seat of intense inflammation.

The Effects of Alcohol upon Digestion.

Professor Kochlakoff, of St. Petersburg, has experimented on five healthy persons, aged from twenty to twenty-four years, with reference to the effects of alcohol upon digestion. Ten minutes before each meal, each person was given about three ounces of alcoholic liquor, containing from five to fifty per cent of alcohol, which is about the proportion found in ordinary liquors. The following results were obtained: —

"Under the influence of alcohol the acidity of the gastric juice and the quantity of hydrochloric acid, as well as the digestive power of the gastric juice, are diminished. This enfeebling of the digestion is especially pronounced in persons unaccustomed to the use of alcohol." The author's experience and observations fully confirm these statements.

Dr. Figg, of Edinburgh, made the following experiments to test the effect of alcohol upon digestion: He fed two dogs equal quantities of roast mutton. He then administered to one dog, by passing a tube into the stomach, one and one-fourth ounces of alcohol. After five hours both dogs were killed and examined. The one which had taken no alcohol was found to have digested the meal entirely, whereas digestion had scarcely begun in the animal to which alcohol had been administered.



EFFECTS OF ALCOHOL UPON THE VITAL ORGANS.

Several years ago, the author made an experiment for the purpose of determining the influence of alcohol upon digestion, in the following manner: A young man was given a test meal consisting of an ounce and a half of bread and two ounces of water. At the end of one hour the digesting food was removed from the stomach, and the progress of digestion carefully noted. The experiment was then repeated upon the same young man, two ounces of water being replaced by an equal quantity of claret, when it was found that the amount of digestive work was reduced to one third of the former amount. Repeating the experiment again, replacing two ounces of water by an equal amount of brandy, the digestive work accomplished was found to be less than one eighth the normal amount, the stomach being almost completely paralyzed.

Alcoholic Insanity.

The condition of a man under the influence of liquor is precisely that of an insane man, as regards his mind. When getting drunk is frequently repeated, the condition of the mind induced by drink may become permanent, making the individual a fit subject for an insane asylum.

Intemperance, more than any other cause, fills our lunatic asylums and institutions for the feeble minded. According to the statistics of insanity in France, thirty-four per cent of the cases of lunacy among males is due to intemperance. One half of the inmates of the Dublin insane asylum owe their disease to the use of liquor. Lord Shaftsbury, chairman of the English commission on lunacy, in his report to Parliament, stated that six out of every ten lunatics in the asylums were made such by alcohol.

A Drunkard's Liver.

The appearance of a drunkard's liver is characteristic. "Hob-nailed liver" is another name for the diseased organ as found in spirit drinkers. It is shrunken, hard, and almost totally useless, benumbed alike to pain and proper sensibility. Externally it looks like the hob-nailed sole of an English cartman's shoe, from which resemblance it received its name. This kind of liver is found in those who have freely indulged in drink for several years. The livers of more moderate drinkers are found filled with fat.

These derangements of the liver give rise to numerous other disturbances, of which abdominal dropsy is one common form. Diabetes, a very fatal malady, especially in spirit drinkers, is a peculiar disease which is generally caused by some of these derangements of the liver. Fatty liver, in which the organ sometimes becomes enormously enlarged and changed to fat, and "nutmeg degeneration," in which it comes to resemble the smooth surface of a half-grated nutmeg, are also among the common effects of alcohol upon habitual users of the poison.

Alcoholic Consumption.

Sir B. W. Richardson pointed out the fact that alcohol, instead of preventing, actually produces consumption, and that of a most fatal type. He stated that a person suffering from alcohol phthisis shows no improvement under treatment. The disease steadily, surely, and usually quite rapidly, progresses to a fatal termination.

Alcohol vs. Strength.

The laborer, the traveler, and the soldier use alcohol under the delusion that it produces strength. When fatigued, the laborer takes a glass of grog, and feels better, or thinks he

does. He imagines himself stronger. His increased strength, however, is wholly a matter of imagination.

The use of alcohol makes a man *feel* stronger,— makes him believe that he can do more work, endure more fatigue and hardship, and withstand a greater degree of cold than he could without it; but when an actual trial is made, it soon becomes apparent that the ability is lacking. Numerous experiments have shown that alcohol decreases muscular strength. Says Dr. Brunton, "The smallest quantity takes somewhat from the strength of the muscles." Says Dr. Edmunds, of London, "A stimulant is that which gets strength out of a man."

Some years ago the author made a series of experiments for the purpose of determining the influence of alcohol upon the muscular strength. The combined strength of all the different groups of muscles in the body was found, in the case of a healthy young man, to be 4,881 pounds. The young man was then given two ounces of brandy, and the test was repeated, when his strength was found to be only 3,385, a loss of more than one third. A notable diminution in strength was still present ten hours after the administration of the brandy.

Alcohol vs. Animal Heat.

The sensation of warmth produced by taking a glass of wine or brandy is delusive. The circulation is unbalanced, and for a few moments there is a seeming increase of heat, but the thermometer shows that the temperature is really lessened. Dr. Parkes, the eminent English sanitarian, says: "All observers condemn the use of spirits, and even of wine or beer, as a preventive against cold." The names of Dr.

King, Dr. Kane, Captain Kennedy, and Dr. Hayes may also be cited as holding to this opinion. In the last expedition in search of Sir John Franklin, the whole crew were teetotalers.

Professor Miller states that the Russian military authorities "interdict its use absolutely in the army *when troops are about to move under extreme cold,* part of the duty of the corporals being to smell carefully the breath of each man on the morning parade, and to turn back from the march those who have indulged in spirits, it having been found that such men are peculiarly subject to be frost bitten and otherwise injured."

Dr. Carpenter is authority for the statement that the Hudson Bay Company have for many years entirely excluded spirits from the fur countries of the North, over which they have exclusive control, "to the great improvement," as Sir John Richardson observed, "of the health and morals of their Canadian servants and of the Indian tribes."

Alcohol vs. Longevity.

It is very easy to prove that the influence of alcohol, as of every other poison, is to shorten life. Dr. Willard Parker, of New York, shows from statistics that for every ten temperate persons who die between the ages of twenty-one and thirty, fifty-one intemperate persons die. Thus it appears that the mortality of liquor users is five hundred per cent greater than that of temperate persons. These statements were based on the tables used by life insurance companies.

Notwithstanding the constant protest of both moderate and immoderate drinkers, that alcohol does not harm them, that it is a necessary stimulus, a preventive of fevers, colds, consumption, etc., and the assertion of certain chemists that

it is a conservative agent, preventing waste and so prolonging life, the distinguished English actuary, Mr. Nelson, has shown from statistical data which cannot be controverted, that while the temperate man has at twenty years of age an average chance of living forty-four and one-fifth years, the drinking man has a prospect of only fifteen and one-half years of life. At thirty years of age the temperate man may expect thirty-six and one-half years more of life, while the dram-drinker will be pretty certain to die in less than fourteen years.

The Rechabite societies in England show statistics clearly indicating that total abstinence from the use of alcohol is in the highest degree conducive to longevity.

Alcohol Not a Stimulant.

The popular idea that alcohol is a stimulant is doubtless the chief occasion for its use as a remedy by physicians. But modern researches have shown that alcohol cannot in any proper sense be regarded as a stimulant. It lessens vital activity in all diseases. The giving of alcohol to weak and fainting persons is a most pernicious and injurious practice, as the drug serves to still further depress and weaken the vital forces. The feeling of increased strength imparted by alcohol is deceptive, as we have already seen. This is true in relation to both mental and muscular effect.

Effects of Moderate Drinking.

It is quite useless for moderate drinkers to suppose that by using alcohol in small quantities they will escape its evil effects. It is a poison in all doses. As Dr. Smith says, "In whatever dose, the direction of the action of the alcohol must be the same."

Dr. Chambers says, "The action of frequent divided drams is to produce the greatest amount of harm of which alcohol is capable, with the least amount of good."

The effect of the constant action of a small quantity of the poison is far greater than that of excessive but only occasional quantities. Hence the habitual moderate drinker, even of wine, beer, or hard cider, is much more subject to chronic nervous disorders and degenerations of various sorts than the man who goes on a spree once in two or three months.

Alcoholic Heredity.

Dr. S. G. Howe, attributed one half of the cases of idiocy in the State of Massachusetts to intemperance, and he is sustained in his opinion by the most reliable authorities. Dr. Howe states that there were seven idiots in one family where both parents were drunkards. One half the idiots in England are of drunken parentage, and the same is true in Sweden, and probably in most European countries. It is said that in St. Petersburg most of the idiots come of drunken parents.

Dr. Legrain, an eminent French physician, sums up the results of his investigations of alcoholic inheritance as follows: "In the first generation from inebriety, the mental and physical degenerates were 77 per cent of all; in the second generation, 96 per cent were defectives; in the third generation, not one escaped; all were idiots, insane, hysterical, or epileptics."

Bourneville observed that of a series of 1,000 idiots examined by him, 62 per cent were of alcoholic parentage; Marro noted an alcoholic parentage in 46 per cent of criminals, while 45 per cent of the inmates in the Swiss prisons for juvenile offenders, showed a similar past; and Madame

Tarnowsky found that 83 per cent of the inmates of brothels were the offspring of alcoholic parents.

Proportion of Alcohol in Various Liquors.

Although alcohol is made from fruits, grains, and other substances used as food, it is not naturally found in foods, but is the result of processes which change the wholesome elements of the food into a harmful and poisonous substance. It is also evident that the essential difference between the various kinds of alcoholic drinks is merely in the proportion of alcohol which they contain. Thus, brandy, whisky, gin, and rum are from two-fifths to three fifths alcohol; wine, one tenth to one fifth; cider, one twentieth to one tenth; beer and ale, one twenty-fifth to one sixteenth; small beer, two per cent.

From the above it will be seen that cider, which is by many hardly considered an intoxicating liquor, contains more alcohol than beer, and as much as some kinds of wine. Apple juice, like the juice of the grape, when first expressed from the fruit, is entirely wholesome, but within a few hours fermentation is set up by the germs which the liquid receives from the air and from the fruit itself. Alcohol is thus formed, the quantity increasing until all the sugar present has been converted into alcohol and carbonic acid gas.

Hard cider is a very intoxicating beverage, and produces a very bad form of intoxication. What is called new or sweet cider often contains a considerable amount of alcohol. If the amount is not sufficient to produce intoxication, it may be sufficient to produce an appetite for alcoholic beverages, which will probably lead to the use of stronger liquors. Many persons have become confirmed drunkards in this way. It is quite difficult to tell the exact moment at which cider changes from a harmless to a dangerous beverage. When the liquid

effervesces, as it is certain to do after it is a few hours old, it invariably contains alcohol.

Bitters.

Many persons are unsuspectingly led into habits of intemperance by the use of various kinds of patent medicines advertised as "bitters," "tonics," etc. Few, if any, of these mixtures are free from alcohol. Some that are said to be free from alcohol, and on that account are called "temperance bitters," actually contain more alcohol than some which make no such claim. Some of the most popular of these nostrums contain as much alcohol as the strongest liquors. "Jamaica ginger" contains so much alcohol that it will burn in a spirit lamp. The habitual use of these compounds is quite as harmful as the use of alcohol in any other form, and sometimes even more injurious on account of the presence of other harmful drugs.

The Medical Use of Alcohol.

The general faith in alcohol as a remedy is unquestionably an evil of stupendous proportions. The widespread faith in alcohol as an invaluable remedy in collapse, fainting, and in almost every emergency has led to the almost universally prevalent custom of keeping on hand a supply of brandy, whisky, port wine, or some other form of alcohol, ready for use should occasion seem to demand. The brandy or whisky bottle nearly always finds a place in the conventional traveling bag.

If one is either to hot or too cold, alcohol, is supposed to be equally good; if one is weak or exhausted, alcohol is the remedy; if one is overexcited, alcohol is again appealed

to. Alcohol is taken as an aid in overcoming drowsiness and is administered for sleeplessness. It is looked upon as an almost universal panacea, and it seems to justify the confidence reposed in it in many cases by apparently relieving the symptom which has been the occasion of its administration, but this appearance of benefit is purely delusive.

Alcohol Never Necessary.

It is probably not too much to say that there is no condition under which the use of alcohol is necessary, and it is indeed difficult to conceive of any condition under which its use as a remedy could be in any way really beneficial. Alcohol has for generations been regarded as the sovereign remedy in collapse and all conditions of great prostration, such as are found in persons who have been rescued from drowning, or who are suffering from sunstroke, or heatstroke, or collapse following hemorrhage or severe injury. At the same time, however, such eminent medical authorities as Dr. Victor Horsley, of London, and others equally prominent, do not hesitate to express themselves in unequivocal terms against the use of alcohol. Says Dr. Horsley, "Surgeons of former days used alcohol extensively to combat shock; but the old theories of shock have been proved erroneous, and alcohol has consequently become unnecessary. It will be less and less used in the future, and the discredit into which it has fallen is justified."

Fortunately there are always simple remedies at hand which are capable of doing everything which alcohol is supposed to do, but which it does not do. In collapse, for example, the most important thing to be done is to arouse and energize the heart. This can be admirably accomplished by chafing the

limbs, spatting the surface vigorously, especially the chest, and rubbing the surface of the body with cold water, employing either the hands or a small cloth dipped in cold water. A towel wrung out of cold water and applied over the heart is an excellent means of energizing this organ when weakened from any cause, as in fainting, the state of collapse which sometimes occurs in fevers and similar conditions.

Sometimes alternate applications of heat and cold are preferable to cold applications alone. A short, very hot application should precede the cold application when the surface of the patient is cold. The cold applications must be of short duration, and accompanied by vigorous rubbing when applied to the surface of the whole body. The surface should be dried and well covered afterward. The cold compress over the heart should be renewed as soon as it becomes appreciably warm. When allowed to become heated, the effect is the opposite to that desired.

THE TOBACCO HABIT.

The poisonous character of tobacco, and the great evils resulting from its use, are so universally recognized it is perhaps unnecessary to devote very extended space to the discussion of this subject. The use of tobacco originated with the American Indian, who chewed it, smoked it in a pipe, made cigars of it, and reduced the dry leaves to powder for use as snuff. Although four centuries have elapsed since the discovery of this poisonous weed, and notwithstanding its use by many millions of civilized human beings, there has been no essential change, certainly no improvement, in the manner of its use.

Tobacco Using a Savage Custom.

Whatever credit is due for the introduction of the tobacco habit belongs strictly and exclusively to the American savage. It is essentially a savage practice, without a single redeeming feature. The marvel is that it is tolerated in civilized society. To a person who lives habitually in a clean atmosphere, nothing is more surprising than the apathy with which the majority of men and women submit to the wholesale poisoning of the air which they breathe in theaters, lecture halls, even churches, as well as on the street, in sleeping cars, street cars, in hotels, in fact, wherever men congregate in the cities and towns of civilized countries. If some lunatic should take it into his head to carry around a stink pot, promenading up and down all the streets of the town, passing through street cars, churches, hotels, and now and then, on some pretense, getting access to private residences, it would not be long before the public would demand the arrest of such a purveyor of filth as a public nuisance.

The Deadly Cigarette.

The cigarette is a most insidious and potent enemy of health and morality among young men and boys. It undermines both the health and morals in a most certain and effective way. Many a young man finds himself as old at twenty or twenty-five years of age as he ought to be at sixty or seventy. His constitution has been dissipated in smoke at the end of a cigarette or cigar. His lungs, liver, kidneys, and other internal organs are almost as densely saturated with smoke as a ham from a smoke house. The "bouquet" of such a man has a whiff of perdition in it.

Adam Clarke said on one occasion that if he were going to make a sacrifice to the devil, it should consist of a pig stuffed with tobacco. An old cigarette smoker would certainly be the proper sort of a person to officiate as priest on such an occasion. The number of men, and women too, we are sorry to add, who are burning up their lives along with the tobacco which they consume while offering incense to the image of the dead Indian which stands in front of every tobacco shop, and the resulting disease, degeneration and death, is simply appalling. If the intelligent men and women of civilized countries could be made to appreciate the evil done by tobacco, they would rise en masse and prohibit the culture, sale, or use of this dirty and noxious weed.

Appalling Statistics.

The magnitude of the tobacco evil can be in some degree estimated by a glance at statistical facts. For many years the amount of money expended for tobacco in the United States alone has been more than half a billion dollars, or more than the cost of food. In the year 1896 more than four billion cigarettes were manufactured, sufficient to furnish half a hundred of these death-dealing devices to each inhabitant of the United States. The evil resulting from the use of tobacco was made remarkably conspicuous in connection with the military examinations during the war with Spain. The examining physicians refused a very large proportion, in some instances as many as thirteen out of fourteen of all applicants, chiefly for tobacco heart from smoking.

Nicotine, which tobacco contains in large amount, is one of the most deadly of all known poisons. A fraction of a drop

will kill a cat in two minutes. Tobacco was once used as a medicine, but has long since been discarded as too rank and destructive a poison to be thus employed.

Tobacco Using and Insanity.

The rapid increase in the number of insane, epileptics, and other forms of degeneracy, within the last fifty years, is unquestionably in large part due to the use of tobacco. When, in 1862, the attention of Napoleon III was called to the fact that the number of lunatics, paralytics, and epileptics to be found in the hospitals of France was five times as great in proportion to the population as thirty years before, together with the fact that the use of tobacco had increased in about the same proportion, he appointed a commission of eminent scientific men to make a careful investigation of the subject. This commission made a very careful study of this question, particularly in the government training schools, in which they divided the students into two classes — smokers and non-smokers — and carefully noted the physical condition, and the amount of work which each class were able to do. The non-smokers were found so much superior, physically, mentally, and morally, to the smokers, that a law was immediately promulgated prohibiting the use of tobacco by students in all schools under government supervision.

Some years later the English government was led to enact a similar law in relation to the use of tobacco in the naval and military schools, actual experiment having shown that the use of tobacco was decidedly prejudicial, both to the physical and mental development of the student.

Dr. Jay W. Seaver, Professor of Physical Culture in Yale College, who has for many years made a careful study

of the influence of tobacco upon physical and mental development, found that the nonsmokers during their course of study increased in height twenty-four per cent more than the tobacco users. The increase in chest capacity was more than seventy-seven per cent in favor of the nonsmokers. Dr. Hitchcock, of Amherst College, has made similar observations.

Legislation Needed.

It is clearly the duty of all intelligent men and women to take a strong stand against this evil, and to make earnest efforts to secure such legislation as will prohibit the manufacture, sale, and public use of this most pernicious drug.

TEA AND COFFEE DRINKING.

Probably very few of the millions who daily make use of tea and coffee as a beverage are aware of the fact that these common drugs contain from three to six per cent of a deadly poison. The amount of tea and coffee imported annually into the United States alone is more than one billion pounds, or five hundred thousand tons, containing more than fifteen thousand tons of a poison so deadly that twenty grains might produce fatal results if administered to a full-grown man at a single dose, amounting to more than ten billion deadly doses, or six times as much as would be required to kill every man, woman, and child on the face of the earth.

Insidious Poisons.

The question is asked, "Why, then, are not these deadly effects more apparent, and more frequently manifested?" In reply it may be said, first, that the poisonous effects of the

use of tea and coffee are so widespread and so well-nigh universal that this very fact serves to conceal the injury done. The bad effects which really flow from the use of tea and coffee are attributed to other causes, such as overwork, sedentary habits, climate, germs, and other influences which may indeed be incidentally involved, but are not primary in their influence. Further, we will say that the poisonous effects resulting from the use of tea and coffee are very decidedly manifest to one who has given thought to this question, and has made careful observations in relation to it. The sallow complexion, common among women of the higher classes who have reached middle life, the almost universal nervousness among American women, and many common digestive disorders, and the increasing prevalence of nervous or sick headaches, afford to the experienced physician ample evidence of the toxic or poisonous character of tea, coffee, and the allied beverages, cocoa and chocolate. The well-known effect of these drugs in producing wakefulness, banishing as if by magic the sensation of fatigue, affords sufficient evidence of their poisonous character. No one would doubt for a moment the poisonous nature of a drug capable of producing irresistible drowsiness in a person who is not weary. The power of a drug to produce wakefulness in a person who is strongly inclined to sleep as the result of fatigue, is equally evidence of its poisonous character.

Again, the fact that a person who is accustomed to the use of tea or coffee finds himself nervous and uncomfortable when the usual cup is dispensed with, is another proof of the poisonous character of these common beverages which is very frequently in evidence. "I must have a cup of tea or coffee for my breakfast; I am good for nothing without it for the whole day," is an expression which one often hears. The

conclusion to be drawn from this experience is not that coffee or tea is necessary or beneficial, but the very reverse. The evidence of its harmful and poisonous character is conclusive. No such results follow the incidental temporary withdrawal of ordinary food substances to which one has been accustomed. It is only artificial stimulants or narcotics the withdrawal of which is accompanied by such unpleasant effects.

Poisons in the Cup.

Tea and coffee contain, in addition to caffein, tannic acid and various volatile poisons. Roasted coffee also contains caffein. Each of these poisons produce characteristic harmful effects. The volatile oils give rise to nervous excitability, and after a time provoke serious nervous disorders. Caffein is a narcotic, which has been shown to diminish the activity of the peptic glands and to interfere with digestion.

Wolfe has shown that three grains of caffein, an amount which might easily be furnished by an ordinary cup of tea or coffee, greatly impairs the quality of the gastric juice, lessening its total acidity.

Robert showed that both tea and coffee interfere with the action of the saliva upon the starch of the food, and may even wholly destroy its effect.

Dr. Wood proved that the daily use of a decoction prepared from one ounce of tea leaves produces decidedly poisonous symptoms.

A German physiologist found the digestion to be reduced one third by the use of tea. The tannic acid of tea not only interferes with the digestion of starch, but also prevents the proper digestion of albumin.

Wholesale Poisoning.

The fact that coffee, or some similar substance, is very widely used, does not lessen the force of the argument against it. An intelligent observer residing in Brazil declares that almost the entire country is in a perpetual state of semi-intoxication from the free use of coffee. There are several civilized countries where a similar state of things exists. Tea drunkards are reported to be very common in England and Australia, especially among the poorer classes.

Tea Tippling and Drunkenness.

The habitual use of tea and coffee unquestionably provokes an appetite for tobacco, alcohol, and other narcotics. Unquestionably many a child has been trained to a drunkard's life by tea tippling at his mother's table. The rapid increase of the opium and cocaine habits, which are assuming alarming proportions in the United States and other civilized countries, is unquestionably the natural result of the increasing addiction to the tea and coffee habit. Those whose use of these drugs is confined to sipping a half cupful of weak tea or coffee probably suffer slightly more than some disturbances of the digestion. Such persons do not drink tea or coffee for the nervous effect, but only as a matter of habit, or to please the palate. Those who suffer most from the use of these drugs are the persons who take several cups, three, six, or more cups daily, and who suffer inconvenience when the usual cup of tea or coffee is omitted.

No one can afford to suffer the injury which must result from the use of tea and coffee, or their congeners, even to a limited extent; but those who recognize a dependence upon "the cups that cheer but not inebriate," have already suf-

fered serious damage through the more or less permanent impression which has been made upon their nervous systems by these poisons, and should reform at once if they wish to save themselves from complete nervous shipwreck, neurasthenia, and even worse disorders.

Treatment of the Coffee Habit.

The best means of ridding one's self of the tea or coffee habit is to adopt a dry dietary, making free use of fruits, especially fresh fruits, also stewed fruits and fruit juices. Flesh foods and animal broths and extracts unquestionably excite the nerves, and create a demand for the soothing effect of a narcotic. Hence, a person who desires to free himself from the alcohol, the tobacco, or the tea or coffee habit, must first of all dispense with flesh foods of all sorts. Condiments must also be discarded, as these irritate and excite the nerves, creating a desire for the soothing effect of some narcotic drug.

The nervousness and irritability which follow the withdrawal of the accustomed drug may be wonderfully relieved by the prolonged warm bath at a temperature of 93° to 96°. The duration of the bath may be indefinite, several hours, if necessary. If there is palpitation of the heart, or a rapid pulse with a feeling of distress through the chest, this may be relieved by the application of an ice bag over the heart, by sponging the spine alternately with hot and cold water, or applying first hot and then cold compresses to the spine, alternating every minute.

Rubbing the whole surface of the body with the hands, dipping them frequently in cold water, is an excellent means of re-enforcing the heart. The wet-sheet pack will some-

times secure quiet, and even sleep, when other measures fail.

The cold mitten friction and cold towel rubbing should be applied two or three times a day for the purpose of toning up the nerve centers. An abundance of outdoor exercise, relief as far as possible from ordinary cares and worries, and a nutritious, easily digestible, and unstimulating diet, are other measures which are important.

The use of substitutes is a snare and a delusion. A hot beverage, made from roasted cereals of some sort, may be tolerated, but it is better to avoid even this, so that the habit of drinking at meals may be overcome, thus getting as far as possible away from temptation.

The Question Box.

IN the following pages are represented, with brief answers, a few of the multitude of questions which have been asked the author by interested inquirers, covering in a general way the leading points relating to hygienic living.

1. What evidence have we that the natural diet of man should consist of fruits, grains, and nuts?

Ans.—According to the Bible (Gen. 1:29), the Creator gave to man as his bill of fare, fruits and seeds, including nuts, while the lower animals were intended to subsist upon the coarser products of the earth. According to the Bible record neither man nor animals were in creation intended to subsist upon flesh foods. There is no record of any permission to eat flesh until after the flood. The permission then was a qualified one,— the blood must be excluded. This requirement was strictly observed by the ancient Jews (Lev. 3:17), and was enjoined upon the Christian church by the apostles and elders (Acts 15:20, 29). After removal of the blood by thorough bleeding of the animal and washing of its tissues, flesh meats are nearly tasteless, and would be by no one considered a desirable article of food, except in case of great emergency and in the absence of other food. The eating of animal fat was also prohibited, and for good physiological reasons. The earliest traditions of the most ancient nations agree in testifying to the nonflesh character of the diet of primitive man. Man's physical structure, his teeth and other digestive organs, as well as his affinity with the gorilla, the chimpanzee, and other fruit- and nut-eating animals, agree with the ancient records in indicating that his natural dietary consists of fruits, nuts, and soft grains, excluding flesh foods of every description.

2. Do not the findings of geologists prove that the diet of primitive man consisted almost exclusively of the flesh of animals?

Ans.— No. The findings of geologists relate not to the first men who lived before the flood, but to the degenerate men who

after the flood became flesh eaters either through choice or necessity.

3. Do not sick persons require flesh food as an aid to recovery?

Ans.— We know of no condition which absolutely requires the use of flesh food, except the absence of other suitable nourishment; and the experience of the writer and of scores of other physicians has amply demonstrated that all curable diseased conditions can be managed even more successfully without flesh foods than with meats or meat preparations of any sort. Indeed, a large proportion of persons suffering from chronic diseases, unless their cases are already hopeless, will rapidly recover by the unaided efforts of nature when the cause of the illness is removed, and a natural dietary of fruits, grains, and nuts is substituted for the ordinary unwholesome bill of fare.

4. But do not the sick require broths and other liquid nourishment? and if flesh and animal extracts are discarded, what can be used as a substitute?

Ans.— Liquid nourishment is often very essential for the sick. Fortunately, abundant provision is made in nature for the needs of invalids, as well as for the needs of those in good health. In the juices of fruits, we have nutriment of a sort exactly adapted to the sick. Fruit juices consist of pure water holding in solution food substances perfectly digested and ready for immediate absorption, and of the highest value as nutrient materials. The juices of animal flesh, on the other hand, represented in animal broths and meat extracts, consist almost wholly of waste or excrementitious substances, the impurities of the tissues, which when removed from the body constitute the urine and other excretions. The chemical analysis shows beef tea and urine to be practically identical in composition. It could not be otherwise; for the urine is simply an extract of the tissues. Beef tea is an extract prepared by the cook; the urine is an extract prepared by the kidneys. The juices of acid fruits are of great value in most acute and chronic maladies. Fruit purees, prepared by thorough cooking and removal of the skins and all insoluble parts of fruits, are very rarely contraindicated. When acid fruit cannot be borne, the juice of stewed raisins, or of

prunes and other sweet fruits affords most wholesome nourishment. When liquid albuminous foods are required, raw white of egg dissolved in water, with or without the addition of a little fruit juice, is far superior to any meat broth or extract. Fresh buttermilk affords a diet which is seldom objectionable. Beaten eggs, with the addition of fruit juice, afford easily assimilable nourishment of the most valuable sort, presenting all the elements of nutrition in an easily digestible form.

5. Can the strength be maintained on a nonflesh diet; that is, can a person who is engaged in hard manual labor abandon the use of flesh without loss of capacity for work?

Ans.— Most certainly. The strongest and most enduring animals are nonflesh eating. The elephant, the camel, the ox, the horse,— all our work animals in fact,— are of strictly vegetarian habits. The strongest and most enduring men are likewise strictly vegetarians. This is true of the peasantry of all countries, and especially of those countries the inhabitants of which are noted for great longevity, as Hungary and Ireland.

6. In discarding meat, should not one add to his dietary some suitable substitute? and, if so, what?

Ans.— This is a matter of the greatest importance. To drop meat from one's dietary without adding something to take its place, will rob the body of nutritive elements which are essential for the maintenance of strength and health. Meat eaters depend chiefly upon flesh for a supply of nitrogen, or albumin, of which the body requires daily a certain amount. When meat is discarded, this element must be obtained from some other suitable source.

Peas, beans, and lentils are excellent vegetable substitutes for meat. Each pound of these substances contains more albumin or nitrogen than a pound of the best meat.

Eggs also are a convenient source of albumin, a pound of eggs containing nearly as much albumin as a pound of the best steak and in a more easily digestible form.

Almond cream, prepared by blanching almonds, and similar preparations of other nuts, from which the skins and other indigestible parts have been removed, are perfect substitutes for meat preparations of all sorts, furnishing the nutritive elements found

in meats in larger proportion and in a more digestible form than they exist in flesh foods of any sort.

Vegetable gelatin, a food product much employed in Japan and China, may also be used to some extent as a substitute for flesh food. Experiment has shown that this product is a perfect substitute for albumin, though the quantity required to produce the same nutritive result is somewhat larger.

7. Are eggs perfectly wholesome nourishment?

Ans.—The principal objection to the use of eggs is the readiness with which they undergo decomposition. Stale eggs are exceedingly unwholesome. A perfectly fresh egg properly prepared, is easily digestible, and contains no waste or poisonous matters. The excrementitious substances found in meats are not found in eggs. It must be admitted, however, that eggs are sometimes contaminated by impure things eaten by the fowls which produce them. The custom of feeding chickens with the carcasses of dead animals and offal of every description, is a reprehensible one. If eggs are to be eaten, they should be obtained from fowls kept in a clean place, and fed upon grain and other perfectly wholesome food. The eggs of fowls which are allowed to pick their living from barnyard litter often indicate by their strong flavor the character of the material out of which they are produced.

8. But is not flesh more easily digestible than vegetable food, and hence to be recommended for persons who have feeble stomachs?

Ans.— Persons who have feeble stomachs are the very ones who should discard flesh, for the reason that meat is digested chiefly in the stomach. It must be dissolved by the gastric juice before it can pass into the intestines. A weak stomach is unable to do this work promptly. In consequence, flesh foods are liable to undergo decomposition or putrefaction, resulting in biliousness, acute and chronic gastric catarrh, and autointoxication. Purees of peas, beans, or lentils from which the skins have been carefully removed, and such highly nitrogenous preparations as almond cream and similar preparations of nuts from which the indigestible portions have been removed, are free from this objection, passing quickly from the stomach into the intestines, where the digestive work may be completed.

An objection has been raised to the substitution of peas and beans for meat, based upon the fact that the albumin in meat is more completely absorbed than that in peas and beans. This objection is not based upon sound facts. Max Rubner, an eminent German authority, has recently shown that while there is less waste through the intestines from meat than from bread and other vegetable foods, a much larger waste occurs through the kidneys, so that the actual amount utilized by the system is much less in the case of meat than of bread, potatoes, and many other vegetable foods.

9. Are fish, chicken, and small game as objectionable as beefsteak and red meats?

Ans.— While the chicken is perhaps somewhat more digestible than some other meat, fish, including oysters, must be regarded as the most objectionable of all meats, because of the readiness with which they undergo decomposition in the stomach and intestines. The fish used as food are for the most part carnivorous in their habits, There seems to be no good reason why one could object to eating a carnivorous animal, such as a cat or a dog, while not hesitating to eat a carnivorous fish. The oyster is a scavenger, living upon the animalculæ which abound in the slime and ooze of the sea bottom. Wild game, as offered in the markets, is generally quite far advanced in decomposition, and thereby rendered unwholesome.

10. Is it best to dispense with animal fats? and, if so, what substitute should be employed?

Ans.— The body requires about one and one-half ounces of fat per diem. This must be furnished from some source. It is better to make use of animal fats than to undertake to subsist upon a dietary in which this element is deficient; but animal fats, even including butter, may be discarded without inconvenience by substituting nuts and ripe olives, which are exceedingly rich in easily digestible fats. Nuts and olives may be used in their natural state, or prepared in various ways, as nut creams, nut butters, and in various combinations with cereals and fruits. Sterilized cream and sterilized butter are the least objectionable forms of animal fat.

11. Are animal oils necessary as medicine under some circumstances?

Ans.— No. The only possible use which the body can make of animal oils is as a food. Nut oils are much more easily digestible than animal oils, and in every way preferable to them. The same may be said of dairy cream. All the benefits which can be derived from animal oils may be more easily obtained from the use of almonds, pecans, hazelnuts, ripe olives, and other vegetable products rich in fat.

12. Has not the human constitution been so changed by long custom that man now requires a flesh dietary, although his original bill of fare did not include meat?

Ans.— If this principle is true for man, it ought certainly to be found true of such animals as the dog and the cat, which are recognized as strictly carnivorous animals. It is a matter of common experience, however, that both cats and dogs thrive better without meat than with it, provided suitable vegetable food is furnished. Hunting dogs, for example, when in preparation for the chase, are not fed upon meat, but upon cornmeal mush, bread, and other similar foods, experience having shown that they have better wind — that is, better endurance — and a keener sense when thus fed than when fed with meat. Many dog fanciers carefully withhold all meat preparations from their animals. This is also a custom with dog trainers. They find their animals more tractable and much more amiable when meat is withheld.

13. What shall a person do who cannot digest nuts?

Ans.—There must be very few persons who cannot make use of nuts in some form, if not in their natural state, in some of the numerous preparations of which many very palatable and easily digestible varieties are now offered. Almond cream will hardly be rejected by the feeblest stomach. If any case should be found in which there seems to be a distinct idiosyncrasy against nuts, the nitrogenous elements required may be easily obtained from macaroni, gluten preparations of various sorts, and even buttermilk or cottage cheese.

14. Why is sweet milk and fresh fruit a bad combination?

Ans.— Milk is always apt to sour and decompose in the stomach if it has anything like a fair chance to do so, and fruit is conducive to the fermentative process.

15. Is it wise that cream should be heated for the purpose of sterilizing it or rendering it more digestible?

Ans.— The purpose is to sterilize it, as recent observations have shown that cream contains nine tenths of the germs of the milk.

16. What is a good fat-producing diet?

Ans.— A diet of fruit, grains, and nuts. Protose, nuttolene, granola, granose, granut, malt honey, malted nuts, browned rice, zwieback, bromose, ripe olives, sweet fruits and fruit juices, and potatoes are all fattening foods. Cream is very fattening, but disagrees with many persons.

17. It has been recommended that peas, beans, and foods having skins on them, should have the skins removed. Is it not necessary to have a certain amount of waste material in our food?

Ans.— Yes; but in cases in which the stomach is dilated, or unable to empty itself readily, a condition which sometimes causes constipation of the stomach, such coarse substances as the skins of fruits are likely to remain in the stomach, encouraging disturbance and promoting infection. The skins of peas and beans are no more digestible than paper, which they resemble in character. A considerable amount of indigestible material is left over after the skins have been removed, which is sufficient for the purposes of digestion. Beans, peas, and lentils are highly nourishing foods, and are not objectionable for persons with strong digestive powers, but give rise to gastric disturbances in persons who have dilated stomachs, or whose stomachs are so weak that they cannot expel the tough, indigestible hulls, which, though softened by prolonged cooking, cannot be dissolved by the digestive fluids. These may be removed by passing the cooked legumes through a colander. Processes are also now in use for removing the hulls before cooking, so that hulled peas

and beans can be obtained in the markets, or of manufacturers of health foods. Attention has also recently been called to the fact that the hulls of leguminous seeds contain uric acid, another reason why these indigestible parts should be discarded.

18. How can zwieback be make at home?

Ans.— Cut stale bread into thin slices, place in a slow oven, and leave until slightly and uniformly browned.

19. Should a person living exclusively on a fruit diet eat only twice a day?

Ans.— No; he should eat three or four times a day, or as often as he feels hungry, if he takes but little at a time.

20. What vegetables are the best food?

Ans.— The ordinary potato, the sweet potato, green peas, green corn, spinach, and tomatoes.

21. Are all fruits good for food?

Ans.— All the fruits generally regarded as wholesome may be safely used. There are, of course, substances botanically known as fruits which are poisonous, and so unfit for food.

22. What do you think of cream cheese made by pouring sour milk into a perforated mold, and allowing it to stand until the whey drains off, and the curd hardens? Is this what you call cottage cheese?

Ans.— Sour milk should be sterilized by boiling before it is fit to use. Thus treated, it is more wholesome than raw milk. It may then be made into cottage cheese in the manner described.

23. Are ordinary roasted peanuts, as obtained from a street vender, digestible and nutritious as an article of diet?

Ans.— No; they are objectionable. Nuts are generally cooked at so high a temperature that they are in part burned, and thus rendered indigestible and lacking as a nutrient. The high temperature separates the oil, and burns it, so that the nuts are very indigestible.

24. Are the dried fruits found in groceries digestible if well chewed?

Ans.— Dried fruits are wholesome, but should be softened by soaking and thoroughly cooking.

25. Is the common preserved date a valuable food?

Ans.— Yes; it is a food, but similar to other fruits which are preserved in cane sugar. The commercial date is a cheap variety which has little natural sweetness. As one finds the native date in the markets of Cairo and Constantinople, he would scarcely be able to recognize it as the same date of commerce. The natives stew these dried and almost tasteless dates in preparing them for use, and thus render them palatable. For export, dates are soaked in molasses or cheap brown sugar, and then pressed. This gives rise to the two well-known varieties of date,— the white, or sugar date, and the black, or molasses date. The only variety of date which can be really recommended is the Tunis date, which is very fat and sweet without artificial treatment; but these dates are very expensive. They cannot be bought in Cairo for less than seven cents a pound, while the ordinary date can be purchased for one and a half cents a pound. The Tunis dates are transported long distances on the back of camels in getting them to market, which adds greatly to the price. In this country they are sold at a price which almost prohibits their general use.

26. Is honey a healthful article of diet?

Ans.— The use of sweet fruits is generally preferable to the use of honey as well as cane sugar. Honey is a more wholesome sweet than cane sugar. It is well, however, to sterilize it by boiling for an hour in a double boiler, thus killing the germs which promote fermentation, of which honey contains large numbers. Honey disagrees with many people because of the essential oils gathered from the flowers, and perhaps in some cases because of an excess of formic acid introduced by the bees to prevent fermentation.

27. Will fruit and granola perfectly nourish the body for an indefinite length of time? If so, how much is necessary for a meal?

Ans.— Yes; with the addition of some food containing fat, as nuts or nut products. The body requires about twenty and one-half ounces of food a day, of which sixteen ounces, approximately, must be starch, three ounces albumin, and one and one-half ounces fat. A pound of granola, six to eight ounces of protose, or a quarter of a pound of nuts, and a couple of pounds of fruit would easily constitute a sustaining diet.

28. Is granola, cooked or moistened, subject to the same objections as other mushes for one observing a dry diet?

Ans.— No; for the reason that the starch which it contains is very largely predigested. Still, a dry diet is best in most cases.

29. Are tomatoes classed as fruits or as vegetables?

Ans.— From a dietetic standpoint the tomato should be classed as a vegetable, although botanically a fruit.

30. Does green corn agree well with fruits?

Ans.— Yes, when properly cooked. Roasting is the best method.

31. Do cooked fruits digest as well, and combine as well with other foods as do raw fruits?

Ans.— There is little or no difference, provided cane sugar is not used for sweetening. Cane sugar increases the liability to fermentation.

32. Is it detrimental to eat cold meals?

Ans.— No, unless the temperature is very low. Food taken at ordinary temperatures is, on the whole, more natural and more wholesome than hot foods.

33. Are almonds and filberts wholesome when roasted just enough to cause the skins to fall off easily, and eaten dry with whole-wheat bread?

Ans.—Yes; most excellent.

34. Are squash, turnips, and carrots healthful?

Ans.—The vegetables mentioned are wholesome, but by no means the best food for persons suffering from dilatation of the

stomach, or slow digestion. They require more thorough cooking than is possible at a boiling temperature.

35. Are cereal or starchy food indigestible when cooked in fats, as in frying? If so, why?

Ans.— Yes; because saturated with fat. The most important elements of food are starch, albumin, and fat. The starches and albumins are digested in the stomach by the gastric juice, but fats are not changed until they are brought in contact with the bile and the pancreatic juice in the intestines. The presence of fats in a separated state in the stomach interferes with digestion by smearing over the masses of starch and albumin, and preventing the contact of the saliva and the gastric juice. The food is almost entirely protected from the action of the saliva and the gastric juice, and digestion in the stomach is consequently exceedingly slow. The food is retained in the stomach too long, and, as the result, fermentation takes places, particularly butyric and lactic acid fermentation, whereby irritating acids are formed, and heartburn and other disorders produced. Frying is an improper method of cooking any kind of food.

36. Are seven hours too long an interval between breakfast and dinner?

Ans.— No; this interval is often necessary, and is very commonly prescribed by leading French physicians in cases of slow digestion.

37. With a fruit diet should anything warm be taken?

Ans.— There is no harm in taking hot fruit juice or hot lemonade in moderate quantity.

38. Is ice cream injurious?

Ans.— Most certainly. No one ever takes ice cream as food; ice cream is eaten merely for the pleasure afforded by this unnatural preparation. The chilling of the stomach, and the consequent suspension of digestive work, often gives rise to fermentation and decomposition of the food.

39. When you say that grains are good food, do you mean that they are to be made into bread, or boiled?

Ans.— Grains, to be thoroughly wholesome, should be prepared in the form of bread, preferably water bread, made dry and crisp, and baked until slightly brown. Various wholesome health foods are prepared from cereals, being thoroughly dextrinized in the process of manufacture, as toasted wheat flakes, granose, rice, etc.

40. Should fruits be eaten alone or with bread?

Ans.— Either way, as may be required, or as is most agreeable. In certain cases an exclusive fruit diet is required, and sometimes a dry diet of bread or prepared cereals is necessary.

41. What do you think of muskmelons as an article of diet?

Ans.— They are wholesome, but the pulp should not be swallowed.

42. Is there much nourishment in melons?

Ans.— No; they should not be regarded as a food, but rather as a drink.

43. Please name the three best foods, outside of manufactured health foods, for an old person who has no teeth.

Ans.— Browned rice, well cooked; zwieback, thoroughly browned, softened in fruit juice; ripe fruits, such as peaches, grapes, berries, baked apples, and other cooked fruits. As a source of fat, add nut butter made from peanuts or almonds without roasting.

44. Is there any physiological objection to "shortening" in bread? and, if so, why?

Ans.— Free or separated fat, unemulsified fats in any form, butter, lard, or any other form of grease, should be avoided as shortening for bread. Any sort of fat mixed with starchy substances renders them indigestible. Bread shortened with butter, etc., is far less digestible than bread prepared simply of flour and water. The reason for this is that the saliva acts upon the starch only, and cannot act upon the fat. When the starch particles are permeated or covered with fat, the saliva cannot digest them. The same is equally true of the particles of gluten in the bread which are to be digested by the gastric juice.

Emulsified fats, such as nut creams, may be employed without disadvantage. Ordinary cream is preferable to suet, nut oils, or fats.

45. What foods are best for one who wishes to avoid starchy foods?

Ans.— Fruits and nuts. In the majority of cases it is not necessary to avoid starchy foods. It is only essential that mushes and starchy vegetables be avoided, and that the cereals should be taken in the form of breads well-baked, or twice-baked, that is, thoroughly dextrinized.

46. Does simply toasting or baking bread twice make good zwieback?

Ans.— Yes, if the bread is good, and if the baking is continued sufficiently long to brown the slice throughout.

47. Are raw fruits as good as cooked?

Ans.— Yes, and for most persons better. Care should be taken, however, that the fruits are well ripened, and that they are thoroughly masticated, so that they may pass readily out of the stomach.

48. How may nuts be prepared for use?

Ans.— By removing their shells and skins, grinding to a paste, and cooking long at a low heat, with the addition of a little salt, if desired.

49. Are nut oils, cottonseed oil, and similar preparations of vegetable oils to be considered wholesome?

Ans.— No. The chief objection to the use of oil, lard, tallow, butter, and other forms of "grease," is that they present the fat in an artificially concentrated form, in which it does not harmonize with the other elements of food while undergoing digestion in the stomach. In nature the fat is separated or held apart in minute particles, or drops, and these are arranged within the masses of albumin in such a way that they cannot be set free until after the proteid, or albumin, is digested. This arrangement of the fat with the proteid prevents its interfering with digestion; but when fat in the form of oil, lard, butter, etc., is added to the

food, it smears over the particles of gluten, albumin, etc., so that the gastric juice cannot get access to them to digest them; for the gastric juice cannot act upon fats.

50. Is fat essential as an article of diet?

Ans.— Most certainly. Its use facilitates intestinal digestion, encourages the action of the bowels, and aids nutrition in a remarkable way. The amount of fat needed is not large, only one and a half ounces per diem; but this amount is very essential to health. The neglect to supply a sufficient amount of fat is a very common mistake with persons who undertake to adopt a vegetarian regimen. The vitality of the tissues fails under the half-starvation diet, and in many cases tuberculosis in some form, generally pulmonary tuberculosis, is the final result. An unsuccessful attempt to use raw nuts has lead many persons to return to the use of animal fats, with all the attendant risk of infection with consumption and other germs which are known to survive in butter for weeks. The substitution of olive oil, cotton-seed oil, cocoanut oil, and similar products, is a very slight improvement upon the use of lard, tallow, butter, etc.

51. What are the best combinations of foods?

Ans.— Fruits, grains, and nuts agree well together. Fruits and vegetables, fruits and milk, and fruits and meats are bad combinations. Fats in the form of oil or grease disagree with all other articles of food when the digestion is feeble. Milk agrees better with grains than with meats or fruits. Milk disagrees with most persons whose digestion is slow, and is a common cause of biliousness, headache, and sleeplessness.

52. What are the best fruits?

Ans.— Peaches, apricots, grapes, strawberries, blueberries, blackberries, raspberries, oranges, bananas, lemons, apples, pears, plums, cherries, figs, pineapples, and, in tropical countries, the custard apple, sapota, mango, and numerous exceedingly wholesome fruits may be obtained. The olive, green and salted, is extremely indigestible; the ripe olive, properly prepared, is wholesome, and one of the few fruits that contain fat. In the foregoing

list the order in which the names occur indicates very nearly their relative nutritive value.

53. What about jellies and preserves?

Ans.— Ordinary jellies and preserves are very indigestible, and must be discarded by persons with dilated stomachs and slow digestion, conditions which exist with nearly all chronic dyspeptics and most invalids.

54. How about the addition of cane sugar to sour fruits?

Ans.— Cane sugar does not neutralize the acids of sour fruits, having none of the properties of an alkali which destroys an acid by entering into combination with it. Cane sugar only covers the acid flavor. If acid fruits do not agree with the stomach, the addition of cane sugar aggravates the difficulty, instead of relieving it. Acid fruits may be sweetened by the addition of sweet fruits. Raisins, figs, prunes, sweet apples, and other sweet fruits may be used for this purpose. Malted nuts, malt honey, maltol, and bromose are sweet preparations which are readily accepted by the stomach, and which may be combined with fruits in various ways. The sugar of fruits is fruit sugar; that of bromose, malted nuts, and malt honey, is maltose, the natural product which results from the action of the saliva or diastase upon starch. Maltose equals cane sugar in sweetness; levulose, the sugar of fruits and honey, is sweeter.

55. If potatoes are nearly all starch and water, why can they, unlike other vegetables, be eaten with fruit?

Ans.— Potatoes contain less woody material, or cellulose, than most other vegetables, and are the most easily digestible of all vegetables. Recent experiments show that they leave less unusable residue than bread, meat, or even milk. They must be well cooked, preferably baked, and very mealy, and eaten in proper combinations.

56. Do acid fruits combine well with peas and beans?

Ans.— There is no necessary incompatibility, but the hulls of the peas and beans delay the food so long in the stomach that fruits taken with them are likely to ferment. Purees prepared

from peas or beans by removal of the skins are less objectionable, and may be used with fruits, except in cases in which the digestion is exceptionally feeble.

57. What do you think of rain water for drinking purposes?

Ans.— It is wholesome, when sweet, if boiled and filtered, but is in no way superior to distilled water.

58. Do you approve of drinking distilled water in large quantities before meals and at night?

Ans.— Much harm is done by filling the stomach with water just before meals. Half a glass of hot water may be taken fifteen or twenty minutes before eating, in cases of hyperpepsia, and an equal quantity of cold water in cases of hypopepsia, or slow digestion, half an hour before eating. In cases of gastric catarrh, two or three glasses of hot water may be swallowed with advantage an hour before meal time. The same quantity may be taken at night without injury.

59. How much water should one in ordinary health drink daily?

Ans.— Two to three pints.

60. How about water drinking at meals?

Ans.— As a rule, water should not be taken at meals. When used, it checks the flow of saliva, which causes the food to be taken into the stomach without proper mastication, and injuriously affects the action of the digestive juices upon the foods. Fruits taken at meals supply all the necessary fluid, and, at the same time, supply peptogens in the form of acids, fruit sugar, and dextrin, which encourages the flow of the saliva and also of the gastric juice. In hyperpepsia, it is well to take half a glass of hot water half an hour before eating. The water should be as hot as can be swallowed without inconvenience. In hypopepsia, half a glass of cold water should be taken half an hour before eating. It is also well in hyperpepsia to take a glass or two of hot water two or three hours after eating, to dilute the excessively acid gastric juice.

61. What is the proper time for a person to take exercise whose employment is sedendary?

Ans.— Any time is better than none at all. A very good time is at night just before retiring, on rising in the morning, and at noon. It is better to devote a short time to exercise two or three times a day than to exercise but once a day. Sufficient exercise is required to induce vigorous breathing and active perspiration.

62. Is ten or fifteen minutes' exercise on a pulling machine just before retiring beneficial?

Ans.— Yes, but more work is needed; while for most persons at least an hour of active exercise out of doors daily is requisite for the maintenance of sound health.

63. For one employed at desk work, would you advice gymnasium work in addition to outdoor exercise?

Ans.— Yes, so as to afford an opportunity to engage in special corrective exercises for the purpose of combating the deforming effects of desk work. Swimming is, perhaps, the best of all exercises which can be taken for this purpose, as it expands the chest and develops the breathing muscles, while compelling correction of the tendency to curvature of the upper spine, resulting in round shoulders and flat chest.

64. How many hours of sleep, exercise, and study should a college student observe?

Ans.— Eight hours of sleep, two hours of vigorous exercise, and eight to ten of study, including class work.

65. What is a good menu for a delicate child a year old, who has but a few teeth?

Ans.— There are many wholesome foods which could properly be taken by such a child, a few of which are zwieback with stewed prunes, or fruit juice, rice with fruit juice, granose, granola, bromose, malted nuts, stewed fruit, baked sweet apples, and stewed prunes.

66. What is the best diet for a baby four months old who is constipated?

Ans.— Cow's milk is generally harmful in such cases. Stewed fruits and fruit juices, with granola or well-browned zwieback ground fine, may be safely used. White of egg should be added

to the fruit juice, to furnish the proper amount of nitrogen; proportion, the white of one egg to half a pint of fruit juice.

67. What is the best diet for a baby between one and two years of age?

Ans.— Granose, zwieback, malted nuts, browned rice, crystal wheat, granola, zwieback with fruit juice, stewed fruit purees, ripe peaches, apricots, strawberries, and other soft fruits.

68. At what age should a child be weaned, and at what time of the year?

Ans.— A child may be weaned when it has acquired sufficient teeth to eat and chew well crackers, zwieback, and other simple preparations of fruits and grains. The proper time to wean a child is when it is ready to be weaned. If the child is fed on proper food, properly prepared, there is no danger in weaning it at any season of the year. The cooler months are perhaps to be preferred.

69. At what age is safe to begin to feed children fruit?

Ans.— Fresh and thoroughly ripened fruit may be given at any time.

70. What is heartburn?

Ans.— The fermentation of food in the stomach.

71. What causes a bad taste in the mouth?

Ans.— Decomposition of food substances in the stomach, decaying teeth, and the growth of germs in the mouth, causing a coated tongue. A bad taste in the mouth indicates that the vital resistance of the body is lowered; that is, that the body has lost its power to defend itself against germs. The mucus in the mouth is naturally capable of destroying germs. When the tongue is coated, it is because the germicidal power of the mucus has been lost; hence, a coated tongue indicates a general lowering of the vital resistance and a predisposition to disease, which should lead to such changes in the habits of life as will correct these dangerous conditions as speedily as possible.

72. How can one tell when he is cured of dilatation of the stomah?

Ans.— When the breath is pure and sweet; when the tongue is not coated; when the mind is clear, and there is a feeling of well-being. It is not always that a prolapsed stomach can be perfectly and permanently restored to its normal position; but if the dietary is so managed that the stomach is able to digest the food properly, the serious inconveniences which arise from this condition may, for the most part, be made to disappear.

73. What causes an intense hunger when one has sufficient food, and which cease in an hour or so?

Ans.— In most cases, hyperpepsia, a condition in which there is an excessive secretion of hydrochloric acid, generally the result of congestion and irritation of the sympathetic nerve centers.

74. What is beneficial for billiousness?

Ans.— Biliousness is an indication of a foul stomach. A fruit diet for two or three days, taking fruit only for breakfast, dry cereal food at dinner, and no supper, are among the best means for relieving biliousness. Nuts and other wholesome foods may be taken after the first day or two. Keep the bowels open, if necessary, by the use of the enema daily for a few days. It is better, however, to regulate the bowels by adopting a diet consisting of fruits, grains, and nut preparations, which will very soon eradicate biliousness.

75. Can you recommend any compound to aid in the digestion of starchy food?

Ans.— No aid is needed. Nothing is better than saliva. It is only necessary to eat dry foods, and to chew them thoroughly, to obtain all the required assistance.

76. Why should oatmeal cause constipation?

Ans.— As a rule, oatmeal is imperfectly cooked, and for this reason is a prolific source of digestive disorders.

77. What will remove brown spots from the face of one troubled with constipation?

Ans.— The bowels must be regulated by a proper dietary, exercise, and simple hydrotherapeutic measures, and the general

health must be improved. Cold bathing, the cool sitz bath (75° F. for fifteen minutes daily before breakfast), and the wet girdle are excellent measures.

78. What form of indigestion does regurgitation indicate, and what will cure it?

Ans.—The muscular structures of the stomach are irritated. The moist abdominal bandage worn at night will give relief. Care must be taken to avoid irritating food of all sorts. The food must be thoroughly masticated, and in extreme cases coarse vegetables of all sorts and raw fruit should be avoided. Nothing should be allowed to enter the stomach unless it has, by thorough cooking and mastication, been reduced to a bland and pulpy state.

79. What causes a feeling of dizziness in the morning, sometimes accompanied by belching?

Ans.— Indigestion. A careful regulation of the diet, avoidance of all kinds of meats and pastries, and the use of simple preparations of fruits, grains, and nuts, are the measures to be recommended. Cleansing of the stomach with the stomach tube may be necessary once or twice a week at first, or a fruit diet may be adopted for a few days.

80. What causes a heavy, uncomfortable feeling in the stomach after eating?

Ans.—The stomach may be prolapsed, or there may be a nervous disorder of the stomach, rendering it abnormally sensitive, just as a tooth which has a sensitive nerve feels too long.

81. Is there any way to clean a coated tongue?

Ans.—Yes. A fruit diet, with copious water drinking, and the use of grains and nuts, will, in time, effect the removal of the morbid conditions present, to which the coated tongue is due. Improvement of the general vital resistance of the whole body is necessary. The daily cool bath is one of the best means for this purpose.

82. Aside from health foods, what is the best diet for constipation?

Ans.— One consisting of an abundance of fruits and nuts and coarse grain preparations. A handful of nut meats taken with

each meal is a good prescription. Pecans are particularly helpful. Ripe olives are also useful. Steamed figs and well-cooked prunes are excellent.

83. What diet is best in constipation?

Ans.—Take a large bowlful of granose flakes with each meal, eating it dry or with a poached egg. All nuts and nut preparations have a slightly loosening tendency. Milk should be avoided, as well as meats and sweets. Use fruits and graham bread freely.

84. With what diet can acidity be most successfully combated?

Ans.—With a dry dietary. Dry granose, or zwieback, with avoidance of vegetables and animal fats of all kinds, and the free use of nut preparations is the best plan. The food should be eaten slowly, and should be thoroughly masticated. Ripe fruit without sugar may be eaten half an hour after the meal.

85. What diet is best for hyperpepsia?

Ans.—The diet for hyperpepsia and that for hypopepsia need not differ very much. In hyperpepsia there is often great soreness at the pit of the stomach and pain after eating, which renders it necessary to abstain from the use of all acid fruits. A dry dietary is especially to be recommended. Coarse vegetables must be carefully avoided.

86. Why should one be troubled with flatulence after adopting a healthful dietary, when formerly he was not so troubled?

Ans.—This is undoubtedly due to fermentation of starch, caused by wrong combinations of foods, and by imperfect mastication. Avoid the use of mushes. Take care to take the food dry, and masticate it thoroughly. Bread should be taken in the form of zwieback or crisps. Granose, granola, and similar health foods are to be recommended; also malt honey and other foods in which the starch is predigested. Keep the bowels regular.

87. Why should one who has indigestion be troubled with cold feet?

Ans.—This disturbance of the circulation is often caused by the absorption of poisons produced in the stomach as the result of fermentation. These poisonous substances have an irritative

effect upon the sympathetic nervous system, which controls the circulation, and cause spasms of the vessels of the limbs and other parts.

88. What diet and mode of life are best for one who has been troubled regularly for twenty years with diarrhea?

Ans.—The diet should consist of browned rice, granola, zwieback, fruit juices, and a moderate allowance of simple nut preparations. A cold bath should be taken daily, and a moist abdominal bandage should be worn at night. Out-of-door life, especially sun-bathing, will be found helpful. Care should be taken to empty the colon thoroughly at least twice a week by means of a large, hot enema. Wear the moist abdominal bandage at night, and take a cold towel rub every morning.

89. Is there a dietetic remedy for headache?

Ans.—The headache which follows soon after eating can generally be relieved by regulating the diet. Here is a plan which suits the majority of cases: omit the supper. If this does not cure the morning headache, adopt the plan of eating only fruit for breakfast. This will seem a little hard at first, and will perhaps necessitate taking dinner a little earlier. A good plan is to take breakfast at eight o'clock, and dinner at three. If there is discomfort because of an emptiness, and an "all-gone" sensation in the stomach, of which so many dyspeptics complain, eat a little fruit at twelve or one o'clock, or, better, take a little fruit juice. Avoid cane sugar. This will cause the stomach very little trouble, as the fruit will be digested in an hour or two, and some energy will be derived from the fruit sugar contained in it. Thus the stomach will be comforted. Keep the bowels open. Exercise in the open air two hours daily, and take a cold bath every morning.

90. What is the cause of incessant headache during hot weather?

Ans.—The cause may be cerebral congestion. The prolonged neutral bath at 92°, and a cold compress to the head, are to be commended. The headache may result from indigestion or from constipation. Exposure to excessive heat may irritate the brain, especially the direct rays of the sun.

91. Is wind in the lower bowel caused by a prolapsed colon?

Ans.—The cause is probably retention of fecal matter which has not been promptly discharged. This may be due to prolapse or irritation of the colon. An abdominal supporter should be worn for temporary relief. The abdominal muscles should be strengthened by walking in the open air daily, by swimming, and by special exercises, such as leg raising, while lying on the back, and by the employment of special exercises.

92. Is it a natural condition for one to pass gas from the lower bowels? What causes it?

Ans.— No; it is caused by unnatural fermentation and putrefaction in the colon through retention of the fecal matters. The colon must be emptied two or three times a week by a copious enema, employing water at a temperature of 70° to 80°.

93. What is the cause of pimples on the face?

Ans.—A disordered state of the blood, and lowered resistance, in consequence of which the germs which are always to be found upon the skin, find their way into the ducts of the fat glands, there undergoing development, and producing inflammation.

94. What should be the treatment and diet to remove pimples from the face?

Ans.— Keep the face absolutely clean, by washing daily with strong soap, afterward cleansing thoroughly with pure water. Green soap, which can be obtained from the druggist, or soft soap, is best for the purpose. Smear the whole diseased surface with the soap, and leave it on for half an hour, rubbing it in thoroughly. Wash off with very hot water. It is well to bathe the face with hot water for five to ten minutes, two or three times a day. Employ a diet of fruits, grains, and wholesome nut preparations. Avoid the use of roasted peanuts and other preparations prepared from roasted nuts. A daily cold bath, abundance of out-of-door exercise, free water drinking, and the avoidance of greasy foods, rich gravies, butter, and other animal fats, are necessary restrictions.

95. What diet do you recommend for people with weakened digestion and uric acid in the system?

Ans.— Dr. Haig has shown the effects of uric acid on the system and the great prevalence of uric-acid poisoning. Weak digestion is often the cause of the development of uric acid in the system. The diet for such persons should consist as largely as possible of fruits, well-toasted grains, and nuts, taken dry. Avoid meat, cheese, even milk and eggs, if necessary. Live largely out of doors, and sleep with open windows.

96. Why are lemons good fcr rheumatism when the trouble is caused by an excess of acid?

Ans.—The acid of lemons does not increase the acidity of the blood. The same may be said of fruit acids of all sorts. The free use of acid fruits and fruit juices aids in the elimination of uric acid by encouraging the action of the kidneys.

97. Are hot baths on going to bed at night injurious in a case of rheumatism in the knee?

Ans.— No; such a bath ought to be beneficial. It is important, however, that cold friction to the surface be applied in addition, as a tonic measure. Care should be taken not to chill the patient.

98. Is there any way of obtaining relief from pain in inflammatory rheumatism?

Ans.— Relief may be obtained by the hot bath, the sweating pack, and by the application of fomentations to the affected parts. After the removal of the hot cloths, linen cloths wrung dry out of water at 60° or 70° should be applied, carefully covering with flannel and mackintosh or oily muslin, so as to secure quick and thorough reaction. Absolute rest in bed is essential. Flesh meats of all sorts, and animal broths and extracts should be avoided. Water should be taken freely, to the extent of three or four pints, or even more, daily. A large enema should be taken twice a day during the acute stage of the disease.

99. Do weak kidneys effect the eyes? If so, how?

Ans.—Yes; in Bright's disease, the first symptoms are often experienced in the eyes. The acuteness of sight is diminished.

100. Do you consider toasted whole-wheat bread, peanuts, oranges, apples, and peaches safe articles of diet for a diabetic person who is able to work?

Ans.— Recent observations show that the potato is the most wholesome of all starchy food for persons suffering from diabetes. Breadstuffs of all sorts made from wheat and other cereals must be taken in very limited quantity, the less the better. Acid fruits may be used, but not sweet fruits. Nut preparations of all sorts are wholesome.

101. What are the most prominent symptoms of neurasthenia?

Ans.—The symptoms of neurasthenia include those of almost all nervous disorders. The patient is generally depressed, easily excited, nervous, often haunted by morbid fears, restless sleep, languor, easily tired, headache, especially in the back of the head, nervous headaches, creeping, crawling, and various other sensations about the limbs, hands, and feet.

102. What is the best diet and treatment for neurasthenia?

Ans.—The cause must be removed. The most common cause is disorder of the digestion. By the proper diet, proper exercise, out-of-door life, and suitable hydrotherapeutic measures, relief can usually be obtained in a reasonably short space of time. The use of fattening and blood-making foods is of great service in most of these cases. The nervousness is generally relieved by a prolonged bath at 92° to 95° (15 to 30 minutes, to be taken daily). For the general weakness, the morning cold bath, followed by vigorous rubbing, is beneficial. As a rule, the treatment of these cases requires the careful supervision of an experienced physician.

103. How may obesity be overcome?

Ans.— Mild starvation is generally necessary for reduction of flesh. One of the best means of accomplishing this is to give the patient a monotonous diet, that is, require him to eat a single article of food. He will soon get so tired of this that he will be very careful not to eat too much. The ration provided might consist of some such simple food as granose, granola, or granut.

In addition to this simple diet, which should be as free as possible from sugar and fat, the patient should take a cold bath daily. The cold bath should be prolonged as much as possible; hence, swimmming is especially advantageous. If the bath is taken in a tub, the temperature should be 75° to 80°, and should be prolonged for ten or twenty minutes, or as long as possible without unpleasant chilling. The patient should rub himself vigorously while in the bath, so as to maintain active circulation in the skin. He should lie down and sit up in alternation, rubbing the limbs while sitting up and the arms and chest while lying down. Exercise should be taken immediately after the bath until vigorous perspiration is produced. The process of fat reduction may be accelerated somewhat by a sweating bath for twenty to thirty minutes before the cold bath. If walking is chosen as the form of exercise to be taken, the amount required should be ten to twenty miles daily, on a level surface. The exercise should not be taken all at once, but should be divided into three or four stages. If the full amount of exercise cannot be taken at first, it may be gradually increased day by day as the strength increases. The weight should be taken and recorded daily, so that the exact effect of the diet and exercise may be obtained.

104. What diet should one follow who has frequent attacks of nervous asthma?

Ans.—A dry diet consisting of fruits, breads, and nuts, avoiding coarse vegetables. Eat twice a day. Wear a moist abdominal bandage at night.

105. How can one who is susceptible to colds avoid them?

Ans.—Take a cold bath every morning, followed by vigorous rubbing and exercise out of doors for half an hour.

106. Is the vapor bath a good remedy for catarrh of the head and throat? and what subsequent treatment should be given? Also, what other treatment should be pursued?

Ans.—The cold morning bath is to be recommended in place of the steam bath for catarrh. In acute colds in the head, a hot bath at night is often beneficial. The vapor bath, as well as all other hot baths, should be followed by a cold bath of some

sort, such as the rubbing shallow bath, the shower bath, the wet-sheet rub, or the cold towel rub.

107. Is dampness in the atmosphere unfavorable for catarrh?

Ans.— Dampness alone will not produce catarrh. By proper care of the body and preservation of the health the skin and mucous membrane may be kept in a state of health in any climate.

108. What is the remedy for acute catarrh of the throat?

Ans.— Fomentations to the throat at night, followed by a heating compress to be worn during the night, are excellent as a palliative measure. The heating compress consists of a linen cloth wrung out of very cold water, applied about the throat, and covered with three or four thicknesses of flannel, sufficient to keep it warm during the night and to prevent complete drying.

109. What prescription would you advise to be used in the Magic Pocket Vaporizer for dry catarrh?

Ans.—An excellent preparation for general use is oil of eucalyptus and menthol, equal parts.

110. What causes ringing in the ear?

Ans.— Probably catarrh of the middle ear.

111. What will produce natural sleep?

Ans.— Good digestion, sufficient exercise to produce gentle fatigue, and, if necessary, a bath at from 92° to 95° for half an hour, just before retiring. The moist abdominal bandage is also useful. The latter is applied by means of a towel wrung out of cold water so that it will not drip, and covered with several thicknesses of flannel. The daily cold morning bath may also be employed as a means of improving the general health.

112. What can be done for salt-rheum?

Ans.— Salt rheum, or eczema, is a germ disease due to loss of resistance by the tissues, and is often the result of dilatation of the stomach. The disorder of the stomach must be cured before any permanent improvement can be secured in the skin malady. A diet of fruits, grains, and nuts, especially the free use of fruits, and the avoidance of meats, milks, and all animal prod-

ucts, will often effect a cure in a short time. The general health should be built up in every possible way. When the skin is dry and thickened, it should be bathed with very hot water for ten minutes, twice daily. Afterward apply zinc ointment. When the parts are raw and moist, apply a powder consisting of zinc oxide, one part; subcarbonate of bismuth, four parts; starch, twenty-five parts. Carefully protect the parts from the air and from contact with irritating substances of all sorts by suitable covering.

113. What treatment do you recommend for redness of the nose when the patient has not been addicted to the use of alcoholic beverages, but is very susceptible to cold?

Ans.— Correct the diet, if it is wrong, and giving rise to indigestion. Bathe the nose in very hot water for fifteen minutes three or four times a day. It would be well to smear the nose with green soap for ten or fifteen minutes before the hot bathing. It is well to expose the nose to the action of the sun until it becomes sunburned. This will increase the redness for the time being, but the redness will be diminished by repeating the exposure. Consult a skin specialist, as some local application may be needed.

114. What is the cause of and treatment for itching piles?

Ans.— Chronic constipation and the use of condiments are the leading causes. Large and painful hemorrhoids must be removed by a surgical operation. A local irritation may be relieved by a short hot or prolonged cold sitz bath. The constipation must be cured and the other causes removed.

115. Can you suggest a remedy for one who has been poisoned by poison oak?

Ans.—Alkaline solutions of various sorts are the most effective remedies. Dilute ammonia water, a strong solution of baking soda, weak lye, lime water, and, in the absence of anything better, soft soap may be applied. The extract of grindelia robusta, a California plant, is highly recommended as a local application to the inflamed part.

116. What is good for cold feet?

Ans.—The cold rubbing foot bath is the best single remedy for cold feet. This bath may be taken in an ordinary bath tub. Turn on the cold water, but only partially close the escape vent. Then, stand in the tub on one foot, at the same time rubbing it vigorously with the other; then alternate. This should be continued until the feet are red. Rub well with a dry towel.

117. What causes flatfoot, and what can be done for it?

Ans.—Weakness of the ligaments which support the arch of the foot. It is sometimes caused by long standing or taking a long walk. Exercise by walking on the toes with the heels turned outward, and the shoes and stockings removed. In chronic cases, it is necessary to use a plate inside the shoe to support the arch of the foot. This can be obtained from any surgical instrument maker.

118. How is gluten prepared?

Ans.— By washing the starch from flour. The process is somewhat difficult, and cannot be economically done on a large scale without the use of special machinery. For home use, gluten may be prepared as follows: Mix fine wheat flour and water to a rather stiff dough, taking care to mix very thoroughly, and knead a long time. Let it stand an hour or two. Place in a sieve, and allow a stream of cold water to flow upon it, kneading at the same time. The starch will be washed away, while the gluten remains on the sieve. The washing should continue until the water which runs away no longer presents a milky appearance.

119. Which is preferable for winter underwear, linen or flannel?

Ans.— Linen next to the body, supplemented by woolen undergarments.

120. What kind and size of pillow is the best?

Ans.— It is best not to use a pillow at all, but if one must be employed, it should be thin, of hair, wool, or cotton.

121. What is the most healthful material for a bed mattress?

Ans.—The best mattress is a rather hard one, composed of wool, hair, cotton, or other vegetable fiber of some sort.

122. Are feather beds objectionable in winters as well as in summer?

Ans.—Yes; because they are highly hygroscopic. Waste matter is thrown off by the body, and retained by the feathers during the day when the bed is cold, but is thrown off again during the night, thus surrounding the body of the sleeper with an intensely poisonous atmosphere which cannot be otherwise than injurious.

123. What is your opinion of the theory that tuberculosis is far more prevalent among vegetarian animals than among the carnivorous?

Ans.—The statement is true, but the reason is that the carnivorous have been exposed to tuberculosis in their use of diseased flesh foods for so long a time that those very susceptible to tuberculosis have been weeded out; thus a certain hereditary immunity has been established for those left behind.

124. Is the after-dinner nap healthful?

Ans.—No. The nap should be taken before dinner, instead of after. An after-dinner nap may be, to some degree, beneficial in certain cases of hyperpepsia, but even in these cases it would be better to sleep before dinner than after. The process of digestion requires for its perfect performance the wakeful activity of the brain. Digestion cannot be well performed during sleep, neither is sleep as sound and refreshing as it should be while the stomach is occupied with the process of digestion.

125. How long after a meal should the mind be at rest?

Ans.—Persons of ordinary health do not need to give attention to this matter, only refraining from intense application for an hour to an hour and a half after eating; but chronic invalids, especially those persons suffering from hypopepsia, should avoid mental work for at least two hours after eating.

126. Will not food taken just before going to bed conduce to sound sleep?

Ans.—The brain must be active to insure good digestion, and the stomach must be empty to insure good sleep. This is a physiological law long ago recognized. The sense of dullness, or drowsiness, which follows soon after eating, is the result of indigestion; it is not a physiological condition. Those who practice

eating just before retiring often sleep soundly for from two to four hours, then awaken, and find difficulty in getting asleep again. This is due to irritation of the solar plexus, set up by the labor of digestion under unfavorable conditions. The lack of appetite for breakfast after supper has been indulged in, is evidence of the exhausted state of the stomach, as is also the coated tongue and unpleasant taste in the mouth.